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ORIGINAL ARTICLES.

FUNCTIONAL ALBUMINURIA;

OR, ALBUMINURIA IN PERSONS APPARENTLY HEALTHY.

Read in the Section of Practice of Medicine, Materia Medica and Physiology at the Forty-first Annual Meeting of the American Medical Association, held in Nashville, Tenn., May 22, 1890.

BY WM. B. DAVIS, A.M., M.D.,

OF CINCINNATI, OHIO.

Mr. Albert M. came to my office, July 24, 1885, under a good deal of nervous excitement, and requested me to make a thorough examination of his physical condition. I asked him if he was sick? "No," he replied, "I am in perfect health, but I have just been examined for life assurance, and the medical officer has declined my application, because he says I have albumen in my urine, and he advised me to report the fact at once to my physician." I requested him to send me the following evening, three samples of his urine, voided an hour after each meal. I had been his family physician for ten years, and during that period, he had been apparently in the best of health. He had had no sickness, that I can recall, and had not lost a day from his business during that period. An American by birth, of German parentage, nervous temperament, spare build, æt. 30 years, abstemious in his habits, good moral character, married, prosperous in business. Proprietor and general superintendent of a large harness manufactory. Had scarlatina when a child; no history of rheumatism, gout, dyspepsia, or syphilis, in personal or family history; no distinct increase of vascular tension; no cardiac hypertrophy; and no retinal symptoms. Father died at 73 years of age, of bronchitis. Mother living, in good health, aged 71 years; brothers and sisters living, in good health.

My note-book reports the following results of the examination of his urine, tested by boiling and nitric acid:

July 25, 1885, 7 A.M. Color, dark straw; reaction, acid; spec. grav., 1,030. No albumen. No casts.

July 25, 1885, 1:30 P.M. Color, dark straw; reaction, acid; spec. grav., 1,030. Albumen, 1-12 bulk of test tube. No casts, but a few epithelial cells.

July 25, 1885, 6 P.M. Color, dark straw; reaction, acid; spec. grav., 1,030. No albumen. No casts.

A number of subsequent analyses were made with the same results, except that occasionally a trace of albumen was found in his evening urine.

Thinking that his diet had something to do with the production of the albumen, I questioned him closely as to what he ate and drank. He was a temperate man at all times, but occasionally took a glass of beer. I directed him to abstain from the use of beer, and all forms of alcoholic liquors, which he did. Then I directed him to omit eggs from his diet, then meats, then tea and coffee, then milk, and finally, I restricted him to toast and water for his morning and evening repasts, and a bowl of broth for his dinner. A careful examination of his urine, forty-eight hours after the elimination of each article of diet, convinced me that his food and drink had nothing whatever to do with the production of the albumen. I had him under close observation for seven weeks, during which time his appetite was good, digestion perfect, sleep profound, capacity for work excellent, and the albumen appeared in his noon urine with the regularity of clock-work. I had given him no medication, except some tinct. of iron, and I now dismissed him with the injunction to give no further attention to his urine as long as he felt well. I kept him under observation for the next three years, during all of which time he was in good health. October 20, 1888, I made a note of an examination of his urine, which gave the same results as the first report.

On April 1, of this year, I made a very careful urinalysis of his 24 hours' urine, examining separately each specimen as voided.

Whole amount, 40 oz.; reaction, acid; color, dark straw; specific gravity, 1,020; albumen, 0.012 per cent.; quantity of urea normal; no peptones.

Urine passed at 3 A.M. Color, dark straw; reaction, acid; spec. grav., 1,028. No albumen. A few hyaline casts, abundant oxalate of lime crystals, abundant mucus, and an occasional leucocyte.

Urine passed at 8:40 A.M. Color, pale straw; reaction, acid; spec. grav., 1,012. No albumen. No casts.

Urine passed at 1:30 P.M. Straw color; reaction, acid; spec. grav., 1,020. Albumen, 0.016⅔ per cent., a few hyaline casts, crystals of urates, occasional epithelial cell from bladder.

Urine passed at 8 P.M. Straw color; reaction, acid;

spec. grav., 1,020. A trace of albumen. No casts, occasional uric acid crystals.

Urine passed at 11 P.M. Straw color; reaction, acid; spec. grav., 1,025. Albumen, 0.025 per cent., a few epithelial and hyaline casts.

An examination of the 24 hours' urine, passed April 10, at same intervals, revealed the same quantity of albumen, but no casts; a few epithelial cells and uric acid crystals were observed in the 1:30 P.M. urine; specific gravity ranged from 1,022 to 1,030; quantity, 40 oz.; acid, reaction; dark straw color.

Five years have now elapsed since he became aware of the fact, that albumen appeared in his urine at stated intervals. During all of these years, he had not lost a day from his large and responsible business on account of personal illness; he had increased fifteen pounds in weight, and had been and still is in vigorous health. If he had not made application for life assurance, no one would have known that albumen appeared daily in his urine.

A physician of Cincinnati, M. Casset, M.D., to whom I had made mention of the peculiarities of this case, subsequently had two similar cases come under his professional care, and he has kindly furnished me his memoranda concerning them. They may be stated in brief, as follows:

Both were apparently in good health, applied for life assurance, and were rejected because of albuminuria. In one the albumen was uniformly present in the afternoon urine, but absent in the morning. In the other it was observed only after indiscretions in diet, and champagne suppers.

During three years' observation they were not incapacitated from business, and were apparently in good health, although the albuminuria continued the same.

It is scarce more than a century since Cotugno discovered albumen in the urine, and only about sixty years have elapsed since a distinguished physician defined the clinical significance of albuminuria, and thereby attached his name to one of the gravest disorders that flesh is heir to. So profoundly and universally has the profession been impressed with the gravity of albuminuria, as defined by Dr. Bright, that its discovery was looked upon as the death-warrant of the patient in whom it appeared. After a time it was found that albuminuria was frequently present in pregnancy and the puerperal state, in zymotic and other febrile diseases, saturnine intoxication, impediments to the circulation, and other conditions. These discoveries qualified its significance somewhat, but did not materially alter the gravity of its presence in other cases. Then Finlayson, Mahomed, and other authorities demonstrated that Bright's disease may occur without albuminuria, and finally, during the past few years reports have appeared in the medical press, in both Europe and America, to the effect that albuminuria has been detected in persons who were apparently healthy, and these reports have been confirmed by so many able observers that there seems to be no doubt of their correctness. In consequence of these qualifications it is now pretty generally believed that the significance of albuminuria, as first announced, was over-estimated; nevertheless its grave significance is so thoroughly ingrained in the profession that we can scarcely admit of any other condition than a pathological one as being compatible with its presence. Said a prominent physician in my presence quite recently, as he looked into a test tube and saw a precipitation of albumen: "My patient is doomed—there is his death-warrant," pointing to the albumen.

Edes states that the presence of albumen in minute traces, or something which gives a similar reaction with the most delicate reagents, is much more common than its absence, and the amount detectable by heat and nitric acid may be approximately stated as from 10 to 20 per cent. of persons examined. Leube found albumen in the urine of sixteen per cent. of 119 healthy soldiers; Munn found it in 11 per cent. of 200 apparently healthy persons who presented themselves for life assurance. He said that the albuminuria "was attended with no discomfort or unpleasant symptom, and with no discoverable cause for its existence." Mahomed found albuminuria in 15 per cent. of seventy-seven "practically healthy persons" examined for life assurance by him. Granger Stewart reports finding a general average of 31 per cent. among those examined by him. Capitan found in soldiers 45, and in children 89 per cent.; De la Celle says albumen is to be found at times in the urine of 76 to 100 per cent. of healthy persons, both young adults and children; and Prof. Senator says, "I should consider it not improbable that if we were to examine the urine for long periods, at different times of the day, and with care, we should sooner or later find it to contain albumen in the case of every healthy man."

It may be justly concluded from these reports and others that might be given that there are a large number of persons—apparently in good health—going about their business at the present time with albuminuria, and utterly unconscious of the fact. It is a matter of considerable importance to both the public and the profession to make ourselves fully and rightfully informed with regard to them, and of the full clinical significance of the albuminuria. The subject is yet comparatively new, and each case requires a separate and an attentive study, in order to enable us to recognize them when they may happen to fall under our view.

Great confusion exists with regard to the character and manifestation of this form of albuminuria. This is noticeable in the variety of

terms used by writers to designate the particular form or phase of it which has come under their observation. The following are a few which I have met with in our current literature, viz.: dietetic, non-organic, intermittent, remittent, recurrent, non-dangerous, paroxysmal, from muscular exertion, latent, simple, transient, postural, functional, physiological, cyclical, adolescent, mechanical, etc. It has been well said that these are terms permissible only so long as we remain unacquainted with the conditions which produce it. The term "functional" was originally applied by Prout to distinguish it from organic disease of the kidney. "Postural" was applied by Sterling because he observed in his cases that the albuminuria appeared on rising to the upright posture, and "may be made to disappear at any time by merely lying down." "Adolescent" was applied by Moxon because of its frequent observance in youth and early manhood. "Cyclical" was applied by Pavy because he had observed a diurnal variation of its appearance in the urine, of a more or less regular nature, and that which was observed one day was repeated with more or less closeness day after day for weeks, months, and even years. The term "functional" embraces all forms of non-organic albuminuria, and hence my use of the term in designating the class under discussion.

Stewart classifies functional albuminuria as follows, viz.: (1) Paroxysmal, (2) Dietetic, (3) Albuminuria from muscular exertion, (4) Simple persistent.

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Ralfe prefers the following classification: (1) Cyclical, (2) Paroxysmal, (3) Intermittent.

The case I have reported, it will be observed, corresponds to that class which Pavy has termed "cyclical albuminuria."

CAUSES OF FUNCTIONAL ALBUMINURIA.

A distinguished authority on the subject of albuminuria (Mahomed) stated that "although a large amount of attention has been devoted to the experimental investigation of the pathology of albuminuria during recent years, our knowledge of it remains very incomplete, and owing to the contradictory results that have been recorded, what little knowledge we possess appears uncertain." If this be true of the albuminuria of organic disease of the kidneys, how much more is it true of functional albuminuria.

From time to time it has been observed that a variety of causes may produce functional albuminuria, viz.: cold bathing, the ingestion of food, excesses in eating, drinking, and venery, vascular tension, particularly at puberty, passive congestion, cold and wet, privation, depressing emotions, an elongated prepuce, skin disease, posture, prolonged brain work, severe physical exercise, hepatic complications, increased pressure and retardation of blood flow, mechanical pressure, etc. Schrieber has shown that compression of the thorax in young subjects for ninety seconds will cause it, and Ralfe observed that the weight of a soldier's accoutrements upon the chest may have been the cause in the production of albuminuria. The effects of overstudy, combined with anxiety, very frequently produces it in candidates for graduation in our colleges. Prof. Ralfe said, "hardly a season passes but I am consulted by some student who has discovered albumen in his urine whilst reading for his examination, and of whom I hear no further when his troubles are over."

Various theories have been advanced to explain how albumen escapes into the urine in these cases. One states, "that it is due to changes in the secreting structures;" another ascribes it "to a weakened state of the renal vaso-motor centres, which are easily thrown off their balance by exaggerated physiological conditions." Sir Wm. Gull says that "it is due to atony of vessels and nerves." Bartels attributes it to an altered state of blood pressure. He says: "Perfectly healthy kidneys, solely in consequence of an altered state of blood-pressure upon their vessels, can excrete albuminous urine." He further states that the "albuminuria may arise as an entirely transitory symptom from abnormal elevation of the blood pressure, and pass off again as quickly as the cause from which it arose; but, on the other hand, this cause abiding, it too, may endure, and lastly, it may come and go, fluctuating with the varying grades of pressure which produced it." In all of these conditions, he says, the actual per cent. of albumen is but little. Prof. Semmola thinks that albuminuria, in its functional manifestations, is due to the presence in the blood of albumens of greater diffusibility than the normal blood albumen. Moxon and Collins attribute it largely to morbid matters in the urine, particularly oxalate of lime. While many other writers hold to the view that it is due to "changes in the kidneys, brought about by changes in the blood." These conflicting theories and confusion of terms make it apparent that we have made but little progress in our study of albuminuria since the time of Bright. We have learned that more than one form of albumen appears in the urine, and yet, we have blindly acted as though all forms have the same grave significance.

Stokvis, Brunton, Claude Bernard, and others have observed in the urine certain food albumens, generally classed as peptones, and Bruce Jones, Gerhardt, Green, and Bayton have described certain anomolous forms of albumen as occurring in

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the urine, to which the terms of "hemi-albumose," "met-albumen," "leth-albumen" and "albuminose" have been applied. As far back as the year 1878, Prof. Moxon stated that it had been shown by experiment that "some albumens differ from other albumens in the tendency it shows to escape from the renal vessels after the manner of a thing excreted as unsuitable, and hence arose the recognition as probable of a certain incompleteness in the production of peptones or albuminous products of digestion, so that *abortive kinds of albumen* may be found in incomplete digestion, these abortive albumens filtering off through the kidneys and giving rise to albuminuria, which would be no sign of renal disease, but only a result of dyspepsia." After relating the various causes which observation has shown will produce temporary albuminuria, he says: "Albuminuria becomes in relation to disorders of the renal system what neuralgia is to disorders of the nervous system, or what dyspnœa is in disorders of the respiratory system—*a name of a symptom*—which is on the very outskirts of an intimate knowledge of the nature of any case, and thus albuminuria, as Dr. Bright knew it, becomes by-gone and historic." Gerhardt, in the year 1873, differentiated and distinguished albuminuria of fever from that which is strictly renal, and due to structural changes in the kidney. He concluded that the albuminuria of renal disease was serum-albumen, while the albumen incident to the febrile state represented the rapid disintegration of a great number of the red globules.

If we accept the theory that the urinary albumen comes from the blood, it would necessarily follow that more than one coagulable albuminous substance should pass into the urine, for the blood normally contains at least two such substances in solution, viz., the serum-albumen and the globuline. Prof. Senator says, "There is not the slightest ground for the assumption that always, and without exception, only one of these two substances, possibly the serum-albumen as generally supposed, escapes from the blood." Globuline is much more diffusible than serum-albumen, and consequently more capable of passing through a filter.

Bartels says, "Globuline can diffuse itself through animal membranes, and it ought to astonish us, that this substance, which is always contained in normal serum, should not, by reason of its property of diffusibility, pass over constantly into the urine of healthy persons."

Maguire reported three cases of cyclic albuminuria, in which the albumen consisted entirely of globuline. "The ratio of globuline to serum-albumen, was inversely proportional to the gravity of the case." Stokvis considers pathological albumen to be serum-albumen. Pavy observed that the "usual form of albumen met with in renal disease, is serum-albumen; while in cyclic albuminuria, two kinds of albuminous matter are present—one which, like mucin and alkali-albumen, is precipitated—the other corresponds with serum-albumen." Edes states, "When the albumen is found to consist largely or wholly of globuline, that it has a less grave significance than serum albumen."

Sufficient has been said to indicate that the present line of investigation is pointing strongly toward globuline as the form of albumen which is likely to be found in the various forms of functional albuminuria, when chemistry will furnish us with simpler methods, and more reliable reagents for its discovery.

A number of examinations of the albuminous matter found in the urine of my patient, in order to determine whether it consisted of globuline, gave negative results. Prof. Karl Langenbeck, who made the last test for me, says in his report that, "as the best methods for the separation of globuline from ordinary albumen failed, the question arose whether the failure be actually due to the absence of globuline, or whether there be conditions in the urine itself preventing the precipitation. A solution of globuline was accordingly prepared from the crystaline lens of the eye, in a part of which aqueous solution well-washed carbonic acid gas was passed through with satisfactory results. The remainder was added to the urine of 8 A.M. and the carbonic acid reaction again tried. *It failed*, proving that there were conditions in the urine preventing the detection of globuline, even when known to be present."

PROGNOSIS.

It is a matter of deep importance for us to be in a position to say, what will be the future of these cases of functional albuminuria? In the darkness which surrounds them the cry goes forth, "Watchman, what of the night?" Can we in reply say "The morning cometh?" Will they continue simple, or will they culminate in organic renal disease? In reply to this question, Granger Stewart said, "so considerable a proportion of my cases have gone on for long periods without having done so, that I am confident it must be rare when they have such an ending," and he states that he gives a hopeful diagnosis if the quantity of urea is normal, the pulse and heart in a healthy condition, and there is an absence of tube casts. In a case which he reported, he gave the following reasons for giving a favorable prognosis, viz.:

First. "There is a period in every day in which the urine is free from albumen.

Second. "The quantity of urine and urea is normal.

Third. "That except on two occasions, no tube casts have ever been found.

Fourth. "There is no symptom, except the

albuminuria, at all fitted to suggest the idea of renal disease."

Edes says: "Some cases of this kind have been followed for years without the occurrence of any symptoms leading to a suspicion of progressive renal disease. In many the albumen has disappeared without special treatment, and without the change being assignable to any particular cause."

Mahomed says: "For my own part, I am quite convinced that we may have albuminuria with practically healthy kidneys."

Roberts says: "The prognosis in functional albuminuria is favorable. It is now certain that a sensible albuminuria is of much commoner occurrence in healthy persons than has been hitherto supposed."

Pavy, speaking of cyclic albuminuria, says: "In it we have a condition which stands with sharply defined characteristics, upon its own ground, distinctly apart from that belonging to other forms of albuminuria, and without the evidence of existence or pre-existence of renal disease. . . . I could cite cases where a considerable quantity of albumen has been for a lengthened period discoverable without the development of the accompaniments of Bright's disease. . . . Experience has not shown that the disposition exists to pass out of their original form into the class associated with textural disease."

Sir Wm. Gull said: "Albuminuria occurred in growing men and boys almost as frequently as spermatorrhea." He has had case after case of chronic simple albuminuria in young men, and all have ended in complete restoration.

Senator says normal urine is often found to be albuminous, if properly examined. He found albumen in his own urine and that of his three assistants in the Augusta Hospital (Berlin)—"all of us enjoying excellent health," he says. In his own case he found it most frequently during the morning (11 to 1 o'clock), and only exceptionally in the late afternoon after the principal meal; and he further states: "I should consider it not improbable that if we were to examine the urine. . . . with great care, we should, sooner or later, find it to contain albumen in the case of every healthy man."

Klemperer says: "Cyclic albuminuria exhibits no signs of Bright's disease. Indeed, all symptoms, except the albuminuria, may be absent. Its course is chronic; it is the source of no danger to life; it does not become transformed into serious disease of kidney; and it may finally greatly diminish or disappear entirely."

Keating says: "In a large number of cases it is simply a temporary derangement of no more pathological consequence than an ordinary cold in the head, or a bronchial catarrh, and has the same consequence as these."

On the contrary there are those who hold to the view that albuminuria is a pathological condition, and consequently that the so-called functional albuminuria is but a prelude of structural renal disease.

Geo. Johnson says a frequently recurring albuminuria if neglected, will invariably result, though it may be after many years, in structural degeneration of the kidneys. In one case that came under his observation, a period of thirty-six years intervened before a fatal termination.

Munn, in a recent letter, says: "I am satisfied that albuminuria is never a normal condition."

Kinnicutt has never been able to divest himself of an anxiety in regard to the future of such cases, although in a series of cases of "temporary albuminuria" which he published seven or eight years ago, all have recovered but a single case, and that one remained in excellent health.

Nevertheless, the majority of the writers on functional albuminuria hold that it is separate and distinct from organic renal disease, and that the prognosis is favorable.

WHAT ARE THE DISTINGUISHING CHARACTERISTICS OF FUNCTIONAL ALBUMINURIA?

The consensus of opinion, as expressed through medical journalism during the past few years concerning the characteristics of functional albuminuria, may be formulated as follows, viz.:

First. All symptoms of Bright's disease, except albuminuria, are absent. Consequently there is an absence of retinal symptoms, high arterial tension, and hypertrophy of heart.

Second. The person is apparently in good health.

Third. The coloration and the density of the twenty-four hours' urine is normal, or it may be darker in color and heavier in density. The specific gravity may range from 1,020 to 1,030.

Fourth. The quantity of albumen is comparatively small, varying from a slight opalescent cloud to one-fourth of the column of the test tube.

Fifth. There is a period of the twenty-four hours when the albumen is absent from the urine.

Sixth. There is an absence of tube casts.

Tyson says, a consideration which goes far toward establishing the functional character of it, although not essential to this end, is the absence of albumen on rising in the morning.

Janeway says a distinguishing characteristic is its presence in daytime and absence at night.

Ralfe observed that in functional albuminuria the correspondence between the fluid ingested and that passed out of the body follows the ordinary physiological law.

Roberts says, as a rule, with very few exceptions, when the urine is only slightly albuminous, and at the same time dense and highly colored, Bright's disease is not present.

Tyson says, when the quantity of albumen

habitually exceeds one-fifth of the bulk of the specimen examined, he would consider it large. Sterling fixes the limit at one-sixth, Janeway at one-fourth, and Roberts at one-half.

THE SIGNIFICANCE OF TUBE CASTS.

All writers accord a grave significance to the presence of tube casts, evidently regarding their presence as an unmistakable evidence of renal disease. There is no question but that if tube casts are habitually present, and in large numbers, that the evidence of organic renal disease would be indisputable. If, however, they have been observed but once or twice in an extended series of examinations, their presence would have but little significence, particularly if they were absent from several other specimens of urine voided the same day. Tyson says that he has known men with good medical education say that casts were present in a given specimen when there were none, certain granular aggregations having been mistaken for them. Janeway says an occasional occurrence of a hyaline cast can not be considered a proof of chronic renal disease; "they may appear in the urine after very slight and temporary changes, and as quickly disappear." Granger Stewart observed in what he calls "paroxysmal albuminuria," sudden and copious occurrence of albumen in the urine with numerous casts, the process lasting only a short time, and recurring at intervals, and he has never known them prove permanently injurious.

Allchin says: "Casts afford practical information, rarely, if ever, conclusive, when taken alone. . . . The fact that casts are abundant in any sample of urine is not in itself of necessity a serious sign; epithelial casts are met with in the earlier stages of nephritis, and their significance depends on the character of the epithelial cells."

Bartels mentions a case of "transitory albuminuria," where, besides the albumen and other sediment, there was epithelium and a quantity of thick hyaline casts, in which were clustered the ordinary well-conditioned epithelial cells from renal tubes, and after the third day no further casts could be discovered.

Munn reports three cases of albuminuria without casts, which one year later revealed hyaline casts in two cases, and epithelial, hyaline, and granular casts in the remaining one. An examination made a year afterward found the urine of all free from casts but rich in albumen.

TREATMENT.

No line of medical treatment has been found to exert any visible effect upon functional albuminuria. Care and attention should be paid to dietetic and hygienic considerations, and a quiet, even, and healthy mode of life, free from exposure to extreme conditions of any sort, should be adopted, and each case kept under observation.

Until we know much more than we do now of this interesting condition, each case will require a separate study, as a correct generalization will depend upon the study of the individual case.

Life assurance companies have largely been the means of acquainting the profession with the knowledge that albuminuria may be present in persons apparently healthy. These companies owe it to themselves, and particularly to the large class of unfortunate persons, whom they have excluded from the benefits of life assurance, because albumen was found in their urine, that they shall use all means within their power in assisting the profession to an early solution of the significance of albuminuria in such cases.

These life assurance companies have their medical officers in every town and hamlet of our country, and many of the companies are now requiring an examination of the urine of every applicant for assurance. If their medical examiners are competent to make a urinalysis, and if they will keep a careful record of all persons in whom albuminuria has been found, and then by aid of the family physician, keep the persons under observation for a few years, examining their urine occasionally, both chemically and microscopically, and noting whatever changes may occur in them, and then report the results of their observations to the medical directors of their respective companies, the real significance of albuminuria in persons apparently healthy would soon be solved.

AUTHORITIES CONSULTED.

F. W. Pavy, M.D., F.R.S. Medical Times, 1885, Oct. 17; The Lancet, 1886, Vol. I, p. 437; The Lancet, 1888, Vol. II, p. 711.

W. Moxon, M.D. "Chronic Intermittent Albuminuria," Guy's Hosp. Reports, Series III, Vol. XXIII, p. 233, 1878.

Robert Maguire, M.D., M.R.C.P. "The Albumens of the Urine," The Lancet, 1886, Vol. I, pp. 1062 and 1106.

C. H. Ralfe, M.D., F.R.C.P. "On the Classification of the Various Forms of Functional Albuminuria," The Lancet, 1888, Vol. II, p. 953.

T. Granger Stewart, M.D., Prof. Practice and Clinical Medicine, University of Edinburgh. "On Some Forms of Albuminuria not dangerous to life," American Journal of Medical Sciences, 1887, p. 34.

Alexander W. Stirling, M.D., C.M. "Albuminuria in the Apparently Healthy," The Lancet, 1887, Vol. II, p. 1157.

George Johnson, M.D., F.R.S. "On Intermittent, Recurring, or So-called Cyclical Albuminuria," The Lancet, 1888, Vol I, pp. 7 and 999.

Dr. G. Klemperer. Zeitsch. für Klin. Med., B. XI, H. 1 and 2 to 168.

Dr. H. Senator, Prof. Extraordinary of Med. Phys. Royal Charité Hospital, and the Augusta Hospital, Berlin. "Albuminuria in Health and Disease," New Sydenham Society, 1884.

Robson Roose, M.D., LL.D., F.C.S. "Gout and its Relations to Diseases of the Liver and Kidneys," Sixth edition. 1889, p. 114.

Robert Barnes, M.D. "On Cyclic or Physiological Albuminuria," The Lancet, 1888, Vol. I, p. 914.

W. M. Collins, M.D. "On Intermittent Albuminuria," The Lancet, 1886, Vol. I, p. 346.

James Tyson, M.D. "The Relation of Albuminuria

to Life Assurance," Transactions of the Association of American Physicians, 1888, Vol. III, p. 170.

J. M. Keating, M.D. "Examination for Life Insurance," Annual of the Universal Medical Sciences, 1889, Vol. IV.

John Munn, M.D. "Albuminuria in Persons Apparently Healthy," U. S. Life Insurance Co., 1879.

Robert T. Edes, M.D. "On the Absolute and Relative Value of Albumen and Casts in the Diagnosis and Prognosis of Diseases of the Kidney," Transactions of the Association of American Physicians, Vol. III, 1888, p. 139.

Edward G. Janeway, M.D. "Value of Albumen and Casts in the Diagnosis and Prognosis of Kidney Disease," Transactions of the Association of American Physicians, Vol. III, 1888, p. 163.

W. H. Allchin, M.D. "Clinical Significance of Tube Casts," Quain's Dictionary of Medicine, p. 214.

Prof. Carl Bartels. "The Doctrine of Albuminuria," Ziemssen, Vol. XV, p. 41.

Wm. Roberts, M.D., F.R.S. "Practical Treatise on Urinary and Renal Disease," Fourth edition, p. 185.

James Finlayson, M.D. "On the Occurrence of Renal Tube Casts in Non-Albuminous Urine," British and Foreign Medico-Chirurgical Review, 1876, p. 176.

F. A. Mahomed, M.D. "On Albuminuria," Guy's Hospital Reports, Vol. XLII, p. 234.

THE ADVANTAGES AND DISADVANTAGES OF HIGH ALTITUDES IN DISEASES OF AIR-PASSAGES.

Read in the Section of State Medicine at the Forty-first Annual Meeting of the American Medical Association, Nashville, Tenn., May 21, 1890.

BY T. G HORN, M.D.,

OF COLORADO SPRINGS, COL.

In presenting this subject to this honorable body of professional men, I wish to say in the very beginning that I am to a great extent simply giving my own convictions, based upon some fifteen years' experience in an altitude ranging from five thousand to ten thousand feet above sea level, and do not expect to be sustained in general by climatologists.

It is a fact admitted by all physicians, specialists or other, that in all diseases of the air-passages, and especially so in catarrhal, bronchial, and similar diseases of the mucous membrane, as well as in incipient phthisis, the first object to be secured is a climate that will permit a free outdoor life in a pure air.

Intense or even moderate heat, if persistent, throws a physiological strain on the liver, skin and digestive system, and thus prevents proper nutrition, so essential to improvement in disease under consideration.

Again, intense cold throws a physiological strain on the lungs and kidneys, and also interferes with open air exercise, so necessary in such diseases; therefore a climate in which the winter is not very cold and the summer not very warm, should be selected for our patients suffering from disease of the air-passages. We claim these prerequisites in the mountain climate, and particularly so in the Rocky Mountains. As we rise above the sea level to an altitude of five thousand feet, we meet with two important meteorological conditions: the air becomes more and more rarefied, and the heat diminishes, independently of the more or less obliquity of the sun's rays, until we reach a point, known to us as timber line, where the sun's heat is insufficient to melt the snow, and we have the privilege of looking upon the "beautiful" at all seasons of the year.

Dr. J. Henry Bennett says, in one of his valuable articles on climate, that "mountain climate has of late been much recommended for phthisis; that two conditions, namely, purity of air and sparseness of human habitation, are quite sufficient to account for the rarity of phthisis amongst their inhabitants, and for the improvement of the phthisical who resort to them." I venture the assertion that the improvement of the phthisical and the absence of phthisis among the residents of the mountain country, depends largely upon the condition of the atmospheric exhalations of the mountains, the equable temperature, the cloudless days, the electrical current eight to ten miles eastward from the base of the mountains, the absence of humidity in the atmosphere, the unresisting desire to get out doors, the refreshing, exhilerating influence of exercise, the strengthening of lung tissue caused by compulsory expansion while taking exercise in such altitudes, the increased strength of the digestive organs, the assimilation of food, continued muscular development, the attractive, constant and varied scenery, water derived from the eternal snows and ice of the mountain gorges, pure as the crystal formation found imbedded in the granite sides of these majestic rocks, carved and formed into beautiful domes and terraces by the Great Architect of the universe. These are some of the advantages of high altitudes in diseases of the air-passages more apparent, in my opinion, than the want of subjects. In specifying or classifying disease peculiar to the air-passages, benefited by high altitudes and advantages of different localities in same, or differing but little in altitude, I must confine myself to experience alone, and will give such diseases and stage of disease, which are found to be more susceptible to the salutary influence of climate in named altitudes.

We will take, first, the class known as consumptives. This is truly a wide field and covers the entire universe. A class of patients attracting the attention of every physician in the world, and especially the United States. First we select the hereditary tendency, those showing the first symptoms of this dreaded disease, the morning cough, the earliest physical signs of chronic tuberculosis of the apex, without the general appearance of the usual disturbance produced by this disease in the first stage. This class of patients make rapid progress in altitudes ranging

from five to nine thousand feet. The next are patients with more advanced disease, showing hepatization or consolidation, prior to suppuration or disintegration of tissue, even if both lungs are affected, with a pulse constantly at, or slightly above, one hundred, together with a temperature near the same, providing there is no heart complication or serious renal trouble. With proper care and advice the patient improves, and generally rapidly. Cases in which hæmorrhage has been one of the first symptoms, with slight physical evidence of disease; in all such cases I would advise immediate change to the mountain climate, and an altitude not less than five thousand to six thousand feet.

Cases in which the tissue has already yielded, cavity forming, general constitutional disturbance, disease confined to one lung, are frequently saved, disease arrested, and the patient enabled to perform manual labor, or attend to certain kinds of business, earning his own living. I have with me a little pamphlet entitled "What Climate Can Do," which contains a record of personal experience of some of our best citizens who came to Colorado Springs from eight to fifteen years ago, who largely represent this last class I have mentioned, and who are now in good health (comparatively), and attending to their usual avocations. It is prepared by Prof. D. C. Dudley, of the State Institution for the Deaf, Dumb and Blind of Colorado, located at Colorado Springs.

It represents fifty-seven, all of whom are living to-day except the Rev. Mr. Bristol, who died recently from an aggravated form of la grippe. In reference to complications, judgment in all cases is necessary, especially so in heart complications. I have known consumptive patients to improve rapidly who presented organic valvular disease, intermittent pulse and slight hypertrophy, yet those cases are not safe, unless constantly under the care of a regular resident physician. All catarrhal troubles, bronchial disease, except that of positive tubercular deposit, are benefited.

It is generally believed that the higher altitudes are a positive disadvantage in nasal catarrh. If neglected this is true, but the altitude is a great auxiliary to the physician in the proper treatment of catarrh. The secretion peculiar to this disease, and which causes so much deception in lower altitudes in catarrhal affections, is destroyed soon after reaching an altitude of five thousand to ten thousand feet, leaving the diseased membrane clear, dry, and discloses to the physician the extent and condition of the disease, thus enabling him to treat the disease more effectually and secure a permanent cure.

Among the many forms of disease affecting the air-passages, there are none more distressing than asthma, and none so perfectly and permanently relieved. In all cases unaccompanied with heart complications, the relief is immediate, and continues so while in a mountain climate and altitude not less than five thousand feet.

The advantage derived by a change from a lower moist atmosphere to a higher and dry climate in the disease thus far referred to, is absolute and specific. There are diseases heretofore considered doubtful as to the benefit derived by such change that are now classed among the beneficial. I refer to renal disease, rheumatism, general debility, depending largely upon loss of nerve force, assimilation of food and deterioration of the blood; such patients have been, and are benefited by a residence in these localities. To derive benefit from these altitudes in such diseases, the patient must know something of the dangers as well as the benefits and advantages of high altitudes; the very things advised as the best, may become the most dangerous. For instance, the patient is told that outdoor life is the greatest advantage of the high altitude. He concludes that, able or not, he must go out and walk or ride, or sit in the sunshine or under some shade tree. This may prove very beneficial to some and very dangerous to others. I have met patients walking and climbing hillsides until perfectly exhausted, the perspiration starting from every portion of the body, and several miles from their lodging-place. Rest is absolutely necessary, and the cool, inviting shade of some beautiful tree or thick foliage is selected.

The difference in temperature between the sunshine and the shade is far greater than anticipated by the stranger, and before he is aware, or sufficiently rested to return, a damage is sustained from which he never recovers. Again, horseback riding is one of the most common and most pleasant outdoor exercise in our altitudes, and perhaps the most abused. The morning is fine, inviting and promising; a party is soon formed and a start for the mountains. No thought or preparation is made for the common changes met in these altitudes, occurring so frequently after the noon hour. Some one or more of the party is the subject of incipient phthisis, or perhaps, in the second stage. The return in the afternoon may have to be made through an atmosphere very different from the morning, strong wind, recent shower, etc. The result is the invalid receives a shock, the nervous centres are disturbed, the capillary circulation impeded, congestion quickly follows, and the disease has received an impetus, and the climate and altitude an enemy. These are simple facts, yet the greatest hinderance to immediate and permanent relief within the reach of hundreds who come yearly to our mountain resorts and fail to get well.

With a proper knowledge of the peculiarities of the higher altitude and climate, so as to take advantage of the salutary and sanitary conditions offered by these localities, but few, except in the very last stages of consumption, need fear to come,

and with a confident expectation of being benefited. I will here give one case.

H. B., aged 31, from the State of New York, had several hæmorrhages; weight, 109 lbs., slight consolidation in apex of left lung, cavity in right, expectoration excessive, unable to walk two blocks. I advised his father to return with him at once. He (the young man) plead to stay two weeks; gave my consent, watched him closely—to my great surprise began to improve, in three weeks could walk to my office, a distance of six blocks. At the end of six weeks his father left him, and returned to his home. Improvement continued; at end of three months he had gained 15 lbs., was eating well and had every hope of a permanent cure. Soon after this I saw him very early one morning on a milk wagon taking a ride without an overcoat. This was about the 1st of September last. I urged him to get down and go home at once. His fingers were blue and he said he was much colder than he thought. He began to go down; I telegraphed his father, he returned with him, and in three days after reaching his home he died.

This is only one of the many who, through carelessness, lose their chance to derive benefit and secure the advantages offered to them by high altitudes in the mountain climate. Another abuse is diet, and the time and manner of eating. The effect of this dry rarefied air is to increase the appetite. After proper exercise the patient returns with an anxious desire that his meal will be ready, the craving appetite is satiated with food entirely unfit for the condition manifest in the person, the system is already tired from exercise, the food is rapidly eaten, and the result is faulty digestion and a great disadvantage to the patient. How can we remedy these evils, and secure to this class of invalids the great advantage offered to them by such localities? First, by educating them, giving them proper instructions, see that they consult and follow the advice of some regular resident physician. Send them to the best locality suited to their peculiar and individual condition. In speaking of localities, I again confine myself to experience, and suggest the following places in order named:

Colorado Springs, Denver, Col.; Salt Lake City, Utah; Leadville and Pueblo, Col. I speak of these places without prejudice and for the following reasons:

1. Colorado Springs has the greater advantage from location. Altitude fifty-six hundred feet, six miles from the base of the mountains, just the proper distance to get the full benefit of the natural exhalations of the mountains, producing at this point equability and dryness. The only point that this most important atmospheric condition can be found.

2. On the north it is protected by the great Continental Divide, extending east to the Missouri River, on the west by the mountain range, and open to the east and south. The continuous sunshine, averaging three hundred and twenty-five days to the year, giving an opportunity to invalids to bask in the sunshine winter and summer alike. The temperature is remarkable for such an altitude.

I have a record taken by myself for the past fifteen years, at 6 A.M., 12 M., and 6 P.M. I will here give you the average for the past seven years of January our coldest month, and July our hottest month, mean temperature for each month:

For the month of Jan., 1883, 16.3 above.
For the month of July, 1883, 69.2 above.
For the month of Jan., 1884, 16. above.
For the month of July, 1884, 86.9 above.
For the month of Jan., 1885, 15.7 above.
For the month of July, 1885, 82.9 above.
For the month of Jan., 1886, 14.8 above.
For the month of July, 1886, 88.5 above.
For the month of Jan., 1887, 21.3 above
For the month of July, 1887, 83. above.
For the month of Jan., 1888, 18.3 above.
For the month of July, 1888, 85. above.
For the month of Jan., 1889, 16. above.

Again, the inviting appearance of the city. Parks laid out with a special view to the comfort and wants of invalids. Our streets entirely free from mud and less dust than any other point. Every home, even the most humble, having inclosed yards, well kept lawns and magnificent shrubbery. I mention this from the well-known fact to our profession, the wonderful influence, inviting home-like environments, have upon this class of patients. We find this knowledge demonstrated to perfection in our hospital grounds everywhere. The surroundings, the most tasty and beautiful. Beautiful shade trees line both sides of our streets throughout our city.

Again, the drives, the magnificent scenery, so varied and changing, at every turn in the mountain pass; the pure water, the medicinal waters of Manitou, the wonderful medicinal Springs lately discovered within the city limits of Colorado Springs, proven by strong and positive test to be a most valuable remedy in renal, stomach, catarrhal and uterine troubles, all tend to make this one of the first and most salutary localities for invalids in the United States, and perhaps in the world.

In the more serious heart complications, Salt Lake City, Utah, offers the safer haven, situated on the western slope of the Rocky Mountains with an altitude of a little over four thousand feet, very similar to Colorado Springs. While it is a fact that all cases of laryngeal phthisis are thought to be aggravated by the stimulating character of the atmosphere, and variability of the climate in high altitudes, I have seen many cases, well marked, improve rapidly at Colorado Springs.

What I have said in regard to Colorado Springs, as a place of refuge for so large and

various a class of invalids, may be said of other places named in this paper so far as they approach in locality, elevation and other prerequisites, so beautifully and aptly commingled by nature at this point. It is easy of access, being a railroad centre. Six roads entering from every point of the compass. The best educational advantage being the proud home of Colorado College, unsurpassed public schools, together with the religious denominations of every name well represented, and most of them possessing fine church edifices, and not a saloon in the city.

In conclusion, I am confident that when the advantage of these localities in high altitudes are thoroughly known and understood by the medical profession, thousands who must die by remaining in other localities, will be sent to these places and restored to health.

CHOLESTEATOMA OF THE EAR.

Read in the Section of Laryngology and Otology, at the Forty-first Annual Meeting of the American Medical Association, at Nashville, Tenn., May, 1890.

BY B. ALEX. RANDALL, A.M., M.D.,

PROFESSOR OF DISEASES OF THE EAR IN THE PHILADELPHIA POLYCLINIC, ETC.

The subject of cholesteatoma has received a considerable amount of attention on both sides of the Atlantic, yet seems one to which further attention can be profitably devoted. Writers on pathological anatomy are apt to be silent on this point, as though true cholesteatoma were a very rare tumor, met almost solely on the brain membranes; or else they strongly combat the claim that the ear is a frequent seat of the growth. Aural surgeons, on the other hand, too often regard these cases as only desquamative inflammations, and draw no distinction between mere aggregations of exfoliated epidermis and the true pearly tumor. The reason is not far to seek. Desquamative conditions are frequently met, and are open to ready study; cholesteatomata are generally buried in the bony cavities, and are removable only piecemeal during life, and are then nothing more than epidermal shreds, almost indistinguishable from any other flaky masses.

Waiving in great part the question of how often the cholesteatomatous masses met in clinical work are to be viewed as tumors in the strictest sense, I would like to draw attention to their frequent occurrence and their serious importance. A recent statement of Virchow's fittingly opens the discussion: "Of the fatally-ending cases of middle-ear suppuration among us, nearly one-third are to be ascribed to this form of growth."[1] —a statement that for force and authority could hardly be surpassed, and needs no additional citation of authorities. Having had no personal acquaintance with fatal cases of cholesteatoma, not having met them in the few fatal ear cases (generally with meningitis or brain abscess) which I have studied post-mortem, I will turn to the question of its clinical occurrence in the non-fatal cases, which make up in frequency for their presumably lesser gravity. Many varieties of the condition will be met, differing widely in their characteristics, and to this is due the varying names that have been applied, and the divergent views entertained as to their nature. For instance, a colored woman of 50 years, came a year since to the Polyclinic complaining of deafness, tinnitus and some vertigo, growing steadily worse for some months. Both auditory canals were blocked with yellowish, horny masses, which were with much difficulty removed entire. The record showed that similar collections had been removed four years previously, and the diagnosis then made of desquamative otitis externa, corresponds with cases published by Buck, Pomeroy and others. Both drum membranes had been previously destroyed by long-standing suppuration, probably with caries, and the exposed tympanic cavities were lined with cicatricial tissue of the same pearly lustre as the material removed from them. The meatus walls were not free from traces of exfoliating epidermis, but it was very evident that the plugs were derived from within the tympana, as the desquamation of the pearly lining. The connection of the inmost part of the mass to the tympanic wall was partly organic, and broken only by force; and no clear distinction could be made between the most recent portion of the removed mass and that which still covered the promontory, and bled when lightly scratched. The absence of suppuration made the study easy in this instance.

More often pus is present when the case comes for treatment, and the condition is thereby much obscured. Such was the case of an inmate of the Deaf and Dumb Institution, Lizzie W., æt. 9, seen May 12, 1888. Cleansing of the discharge from the right meatus showed a large destruction of the drum membrane, with apparent loss of all three ossicles, and stuffing of all the depressions with white, flaky epidermis. This was removed with great difficulty by syringe, probe and forceps in alternation, and it is very doubtful if the attic and antrum have ever been emptied. A dark point the size of a pin's head, halfway out the posterior wall of the canal, called for investigation, and proved the summit of a similar epithelial mass lodged in the neighborhood of the antrum. The small opening in the skin was stretched in dragging forth the material within, until it revealed an opening in the bony wall through which a large pea might pass; and the cavity within, when finally emptied, was found to measure nearly 15 millimetres in each dimension. The laminated masses of epidermis removed from it would have filled a drachm vial. Only

[1] Trans. Berlin Med. Soc., 1889, p. 58, Arch. f. Ohrenh., xxviii. October 18, 1889.

after numerous sittings was approximate completeness attained in the cleansing. Then suppuration promptly ceased—to recur once or twice in the past year, when the collection of epithelium had formed anew.

A still more notable case was that of a fellow-pupil in the same institution, Susan C., æt. 14, who was brought with suppuration of both ears. The greatly altered tympanic cavities were so tightly packed with pearly epidermis, that only after six or eight sittings of half an hour's duration, when forceps, probe, curette and syringe were used to the exhaustion of both patient and surgeon, were the tympana emptied. Drum membranes and ossicles were gone on each side, and a glazed cicatricial tissue covered the visible surfaces. At the next visit the right ear was dry; but on the left some suppuration continued, a few epidermal flakes were visible, and the probe and curved forceps drew away a good deal more of the same material from the attic and the entrance to the antrum. Although now clean, as far as sight and touch could determine, continued syringing was ordered, unless the ear remained perfectly dry. This was carried out for three days, and when next seen, there was found a cholesteatomous mass filling the auditory canal, and measuring on removal 26×8×6 mm. It was doubtless swollen by imbibition of fluid, but after drying was still nearly as large in each dimension; and one could but wonder where there had been room in the temporal bone for it to hide itself. Suppuration at once ceased, and has recurred only once or twice for short periods, and on this side alone.

So large a proportion of the deaf-mute patients whom I have treated presented this condition in greater or less degree, that I now expect it in the old suppurative cases, and distrust any negative findings until after repeated examination; and I always order the cases showing it to return within a couple of months, even if the ear remains apparently free from any suggestion of trouble. Some of them do so, and renewed collections are generally found; others suffer a renewal of the otorrhœa before the time set for their return, and the removal of the fresh collection is followed by prompt cessation of the discharge.

The first notable case of this kind which I met was Margaret M., æt. about 35, who came in January, 1883, to the Episcopal Hospital. She was very deaf, and spoke a scarcely intelligible German dialect, so that little was learned of the history or subjective symptoms, except that she suffered much with dizziness. Examination showed the left canal clear, and the drum membrane largely destroyed and altered almost past recognition by thickening and adhesions, evidently the results of old, long-standing suppurative disease. On the right the canal was blocked with a mass, apparently cerumen, and its removal showed a condition of the deeper structures closely similar to that on the left. The endeavor to inflate the tympanic cavities probably failed, but some relief seemed to have been obtained. At her second visit, a scale of dark material was still present on the posterior wall of the right meatus, and it was removed as a matter of principle, since several cases of sinus in such a situation had recently been seen. A large sinus was revealed, from which an astonishing mass of material was removed, most of which resembled moist buckskin, but the central portions of which were dry, opalescent, and closely laminated. The walls of the cavity were moist with a pus of strong odor, having a pungency rather characteristic of cholesteatomatous masses. Further relief followed this clearing. At a subsequent visit, the walls of the cavity were found dry, smooth and firm except in the innermost part. The portions visible through the opening in the meatus wall were pale, cicatricial and glazed. The opening into the wall of the canal was found to measure 12 mm. in each dimension; and the cavity in the mastoid extended from the level of the meatus floor to 12 mm. above its roof, and a curved probe could be passed 15 mm. directly backward, and its tip could be brought so far outward as to show that little bone was left between it and the skin. We had therefore a cavity some 20 mm. in height, 15 mm. antero-posteriorly, and extending from near the surface of the mastoid at least 30 mm. inward. Two points were found up and in where the probe met no bony resistance, and pressure caused vertigo and faintness, probably from pressure on the meninges. There was some further improvement in hearing, and less dizziness; but advance soon ceased, and as she was near confinement, she dropped out of sight. The wonder was in this case, that there was room in the mastoid for such a cavity; and there was probably here a beginning of that encroachment of the mass upon the cranial cavity, which has been so marked in some of the fatal cases described.

In a closely similar case more recently seen, the woman was seriously ill, with high fever, severe pain, and much mastoid tenderness on the right; but the acute symptoms were in large part due to a developing quinsy. Polypoid masses filled the meatus, and by their recurrence after removal, obscured the condition; but enough epithelial flakes were removed at the first sitting to indicate the probable nature of the trouble. Cleansing with syringe, probe and forceps, was pushed as far each time as the patient's condition permitted, and when last seen, two months later, the large cavity above and behind was clear and dry, except for the trace of discharge which came from some granulations on the inner lip of the sinus, where the polypus had formerly grown around a small carious point. Instillation of warm water showed that the capacity of the cav-

ity and canal was at least double that of the normal canal upon the other side. A fraction of the hearing had been gained, and the patient considered herself well.

In each of the cases cited, the formation was quite surely secondary to destructive suppurative inflammation; and the cases are extremely few where this can be excluded, and the growth regarded as primary. Yet such cases have been reported by Lucae, Kuhn, and others, as occurring in the mastoid without perforation or other evidence of previous inflammatory trouble; and similar growths have occurred independently upon or in the drum membrane. Politzer has found small pearly bodies in the mucous membrane of the promontory, clearly comparable to those usually met in epithelioma, and probably ready to develop, under favoring conditions, into the conspicuous masses under discussion. Primary cholesteatoma of the ear must, therefore, be accepted as a reality, and as probably less rare here than in other situations. Secondary cholesteatoma, varying from pearly tumors, distinguishable only by their nuclear mass of caseous matter, if at all, from the primary, to mere desquamative masses of indeterminate form and structure, are of quite frequent occurrence. Toynbee noted ten such tumors, aside from epidermal collections in the external meatus, among 1,013 diseased temporal bones, and all observers of wide experience confirm such findings. Their importance lies largely in their tendency to form insidiously in cavities, where they are out of sight and reach, and to maintain and aggravate the inflammatory processes of which they are usually the results. Continued growth leads to absorption by pressure of the surrounding walls, widening the cavities and laying open the important adjacent fossæ. Huge tumors of this sort have been found invading the cranial cavity, and leading to fatal brain disease. The lateral sinus has been laid open by them, and thrombosis or hæmorrhage has ensued, with fatal outcome; or septic osteitis has been set up, with resulting pyæmia. These are their more direct results: they constantly interfere mechanically with the drainage in suppurating cases, increasing the danger, extending the destruction, and forming most serious obstacles to successful treatment. Their removal is often very difficult, and their recurrence probable and dangerous; so the claim with which this paper opened, that they are worthy of most careful study, seems fairly sustained. Awkward as is the name cholesteatoma, its employment in this connection has no small value; for it better suggests the importance and tendency of the pathological condition than does the misleading, if correct, term, desquamative inflammation. Many of the text-books regard these conditions as usually belonging merely to the external auditory canal; and I believe that many students have, like myself, winnowed the instructive from the misleading in these descriptions only after some trying personal experiences have furnished a much needed key. That there may be others to whom the subject is almost unknown, is my reason for placing upon record these incomplete notes.

DIAGNOSIS AND OPERATIVE TREATMENT OF GUNSHOT WOUNDS OF THE STOMACH AND INTESTINES.

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(*Continued from p. 320.*)

Hydrogen Gas Test as Applied in the Diagnosis of Perforating Gunshot Wounds of the Abdomen.

I have up to the present time applied this test in over one hundred cases of gunshot wounds of the abdomen intentionally produced in dogs, and in every instance where the stomach or intestine was wounded, the visceral complication was positively diagnosed before the abdomen was opened; hence I have no reason to make any retraction from the claim previously made, that the test is infallible in making a positive differential diagnosis before abdominal section is made, between a simple penetrating gunshot wound of the abdomen and a penetrating wound complicated by visceral wounds of the gastro-intestinal canal.

In all these experiments the animal was strapped on one of Pasteur's operating tables, the abdomen shaved, and after the animal was fully under the influence of an anæsthetic, the shooting was done with a 32-calibre revolver. Rectal inflation of hydrogen gas was practiced immediately after the shot was fired, and after its diagnostic indications were carefully studied and noted, the abdomen was opened and its contents examined for visceral injuries. In all cases where the colon was perforated, inflation could be done under very slight pressure, as the gas readily escaped into the peritoneal cavity and from there through the wound of entrance, where it was ignited as it escaped. If the perforation of the intestine was located above the ileo-cæcal valve, more pressure was required, as the resistance offered by the ileo-cæcal valve had to be overcome before the small intestine could be inflated. I will cite only one of the many experiments.

"*Experiment 65.*—Dog, weight twenty-five pounds. Under full anæsthesia the animal was shot in the abdomen, the bullet passing nearly in a transverse direction through the abdominal cavity, an inch and a half below the umbilicus,

the points of entrance and exit being midway between the linea alba and spine. Rectal insufflation of hydrogen gas made under very low pressure was followed by rapid distension of the abdomen, an occurrence which furnished strong evidence that the gas escaped through a perforation of the colon into the peritoneal cavity. The gas escaped at once from the wound of entrance and when ignited burned in a steady blue flame. On opening the abdomen, gas escaped from the peritoneal cavity, the small intestine was empty, and only a small quantity of gas was found in the colon. The following intraperitoneal injuries were found: Four perforations of the duodenum, two of the jejunum, and one of the cæcum, also a perforation nearly through the center of the left kidney, laceration of the receptaculum chyli, and a number of perforations in the mesentery. The bullet was found between the left kidney and the abdominal cavity."

In this experiment, as in all others of a similar nature, the gas escaped through the lowest perforation and accumulated in the peritoneal cavity until the intra-abdominal pressure became sufficient to force it through the perforation in the abdominal wall.

In using the hydrogen gas test in the diagnosis of perforating gunshot wounds of the abdomen it is of the greatest importance to observe carefully the effects of the inflation in changing the form of the abdomen. If the colon is perforated the gas will escape readily through the opening in the bowel under low pressure, probably not more than quarter to half a pound to the square inch. As the gas accumulates in the free peritoneal cavity the abdomen is at once uniformly distended and the free tympanites can be proved by absence of liver dulness. Even if gas should not escape through the external wound, its presence in the free abdominal cavity would be sufficient proof of the existence of intestinal lesions and would consequently be a convincing argument for the necessity of laparotomy.

If no intestinal complications are present, or if the visceral wound is located above the ileo-cæcal valve, this becomes apparent after insufflation has progressed sufficiently to distend the entire colon, a condition which may be known to be present from the increased width of the abdomen and the area of tympanitic resonance over the distended organ. Auscultation over the ileo-cæcal region will enable the surgeon to tell when the resistance of the ileo-cæcal valve has been overcome, as this will be announced by a distinct and audible gurgling or blowing sound as the gas rushes from the colon through the opening caused by the mechanical separation of the margins of the circular valve into the ileum. As the loops of small intestine one by one become distended from below upwards with the gas, the hypogastric region first becomes prominent and tympanitic, and if no perforations are present, the abdomen becomes barrel-shaped from the distension due to dilated intestines. In this condition the liver is lifted upwards by the distended intestines, the dulness is not effaced as in free tympanites, but the area of dulness is carried higher up.

If the small intestine is perforated some distance from the ileo-cæcal region, the limited distension and tympanites in the hypogastric region caused by the distended intestinal loops below the perforation will soon be displaced by the free tympanites resulting from the escape of gas into the peritoneal cavity.

If the rules laid down in this paper for the treatment of penetrating gunshot wounds of the abdomen are followed, free tympanites will never occur, as the gas entering the peritoneal cavity from an intestinal wound will escape at once through the perforation in the parietal peritoneum which has previously been exposed by incision through the abdominal wall down to this point.

A Clinical Contribution in Testimony of the Value and Reliability of the Hydrogen Gas Test in the Diagnosis of Penetrating Gunshot Wounds of the Abdomen.

The following six cases of penetrating gunshot wounds of the abdomen have come under my personal observation since I have demonstrated experimentally the value of rectal insufflation of hydrogen gas in the diagnosis of traumatic perforations of the gastro-intestinal canal. In the treatment of these cases I relied implicitly upon the indications derived from the test.

Case 1.[2] *Gunshot Wound of Chest and Abdomen; Double Perforation of Stomach; Laparotomy; Death from Hæmorrhage and Shock.*—C. H., a man, seventy-two years of age, was brought to the Milwaukee Hospital by the police patrol, at 7 A.M., July 9, 1888, for a suicidal, bulldog pistol (44-calibre), wound of the chest, inflicted about two hours previously. Pistol held in the left hand, as ascertained from the patient and confirmed subsequently by examination of the direction of the bullet. The patient stated that he had pointed the pistol toward the heart.

Examination, 7 a.m.—Wound of entrance situated in the sixth left intercostal space, surrounded by emphysema. Seventh rib fractured at junction of cartilage and bone. No wound of exit. Patient conscious; complains of severe pain in the epigastric region, increased by pressure. Pulse rapid and weak; vomits and expectorates blood; area of liver dulness diminished. Percussion and respiratory sounds normal. No evidence of hæmo- or pneumothorax.

9 a.m.—Flexible tube introduced and stomach inflated with hydrogen gas from a four gallon rubber balloon. Gas escaped and ignited at the wound of entrance with an audible sound. Field of operation thoroughly disinfected. Patient

[2] The Medical News, Aug. 25, 1888.

etherized and laparotomy made by incision from the ensiform cartilage to the umbilicus. The omentum and stomach were drawn forward into the wound. A large perforation, about one and a half inches in length (the large size being due to the oblique direction of the bullet), was found in the stomach, midway between the pylorus and the cardiac extremity, near the greater curvature. Stomach partially filled with coagulated blood. With the index finger introduced through this perforation, another was detected in the posterior wall near the lesser curvature. An opening was made in the lesser omentum, but on exploration of the posterior surface of the stomach, the second perforation could not be found. The blood-clots were removed from the stomach by irrigation through the lower wound.

For the purpose of finding the second wound the stomach was again inflated with hydrogen gas which was injected directly through the perforation. The gas escaped through the posterior opening in a continuous stream, which made it easy to locate the second perforation. The omental opening was enlarged by tearing, and the perforation was discovered on the posterior surface near the lesser curvature and close to the cardiac orifice. Great difficulty was experienced in dragging the stomach sufficiently forward and downward into the abdominal incision to enable me to suture the perforation, which was two inches in length. It was closed by a continued sero-muscular suture, the anterior perforation by Czerny-Lembert sutures. A large quantity of fluid and coagulated blood was found behind the stomach, in the region of the pancreas. Copious hæmorrhage had evidently taken place at both perforations as well as in the post-peritoneal space. The visceral wounds indicated that the bullet had passed from above downward, backward, and to the right.

At this stage of the operation the patient collapsed from the continued effect of shock and hæmorrhage. The foot of the table was elevated, external heat applied, and a saline infusion to the amount of fifteen ounces was made into the left median basilic vein. Brandy was injected subcutaneously and the faradic current applied, but all these means proved fruitless, and the patient died from the combined effects of hæmorrhage and shock before the external wound could be sutured.

After death the abdominal incision was closed and inflation of hydrogen gas, *per rectum*, made to test the condition of the sutured perforations. A stomach tube was introduced and the gas, under a pressure of less than a pound to the square inch, was forced through the entire gastro-intestinal canal and escaped through a small glass tube which had been inserted in the distal end of the stomach tube, where it was ignited and burned in a continuous flame as long as the pressure upon the rubber balloon was continued. This showed that both visceral wounds had been effectually closed and that no other perforations existed.

The necropsy, which was made at once, revealed that the bullet had entered the chest through the seventh rib near the junction with the costal cartilage, causing a comminuted fracture. The pleural cavity at this point was obliterated by adhesions. The bullet passed through the lower lobe of the left lung, after which it perforated the diaphragm and entered the abdominal cavity, passing through the cardiac extremity of the stomach from above downwards. Liver and spleen intact, upper margin of tail of pancreas lacerated. Bullet passed to left of the aorta, entered the left crus of the diaphragm, fractured the last rib at the neck and perforated the spinal column, entering between the last dorsal and first lumbar vertebræ, escaping through the body of the latter, fracturing at the same time its right transverse process. The bullet was found in the subcutaneous connective tissue in the right lumbar region. The spinal canal was opened by the bullet in its passage through the vertebra, and loose fragments of bone lay in the canal. The membranes were intact and the cord itself not injured.

Remarks.—The location of the wound of entrance in this case did not indicate that the bullet had entered the abdominal cavity, unless the revolver was held in the left hand; in that case, if directed toward the heart, the track of the bullet would necessarily be downward, backward and from left to right. Taking it for granted that the bullet took this direction, it would still have been possible for the stomach to escape injury. The circumscribed emphysema around the external wound and the hæmoptysis, as well as the location of the wound, left no doubt that the lobe of the left lung was injured. The absence of hæmothorax and pneumothorax was explained by the post-mortem, as the left pleural cavity was found completely obliterated by adhesions. Under a pressure of not more than half a pound to the square inch, the hydrogen gas was forced from the stomach through the external wound, where it was lighted and burned in a large continuous flame until it was extinguished by compression with a large moist sponge, thus demonstrating positively the existence of perforations in the stomach.

Although the stomach can be inflated by rectal insufflation of hydrogen gas, the more direct method by using a stomach tube should have the preference in cases of perforating gunshot wounds of the abdomen where from the course of the bullet there exists a probability, or even a possibility, that this organ has been injured. Dr. Ohage's case serves as a warning to apply the test again even after suturing two perforations made by one

bullet passing transversely through this organ, for the purpose of detecting a third perforation should this exist.

Case 2. Gunshot Wound of the Abdomen; Twelve Perforations; Laparotomy; Recovery.[1]—J. J., a young man sixteen years of age, was out hunting on Sunday, September 9, 1888, with some companions, one of whom accidently discharged his 22-calibre rifle at a distance of about one hundred and fifty feet, the bullet striking the patient in the abdomen. The injury caused but little pain, and immediately after the accident the patient walked about forty yards to a farm-house where he was placed in bed. From there he was conveyed on a cot, in a farmer's wagon, to the hospital, some six miles distant. The accident occurred about noon, and he arrived at the hospital at 3 P.M.

Examination.—Patient complains of considerable pain in the abdomen; pulse 80 and soft; his general appearance indicates no serious injury. On undressing him, a bullet wound, with omentum protruding, was found two inches to the right of the middle line, and on a level with the anterior superior spine of the ilium. Left iliac region dull on percussion; and in right a cracked-pot sound was elicited on percussion. A rectal enema was administered, and was followed by a free fæcal discharge, without admixture of blood. (On washing the fæces afterward the bullet was found.)

Operation.—Ether, as an anæsthetic; thorough disinfection of abdominal wall; rectal insufflation of hydrogen gas, followed by the escape of bubbles of the gas, within a few seconds, at the wound of entrance, into which had been placed a hæmostatic forceps, the blades separated so as to render the canal patent. The gas was lighted, and after thorough cauterization of the wound by the flame it was extinguished by the application of a wet sponge.

Laparotomy by median incision, eight inches in length from pubes upward. About a pint of fluid blood in the peritoneal cavity, and hæmorrhage continuing from mesenteric veins at two points of perforation on the mesenteric side of the bowel, and to a less extent from perforations of the mesentery; arrested by ligating *en masse*. Within a distance of four feet, near the middle of the ileum, were found ten perforations, two of which were at the mesenteric border; also four perforations of the mesentery. Another perforation of the bowel was found within four inches of the ileo-cæcal valve on the convex side of the intestine, making so far eleven in all. All were closed by Czerny-Lembert sutures. At two points the perforations were so close together that it was found necessary to invert half the circumference of the bowel on the convex side, thus producing considerable narrowing of its lumen.

[1] The Medical News, November 10, 1888.

Two hours had been consumed in arresting the hæmorrhage and closing the eleven perforations, and the patient at this time had become pulseless, and yet it was deemed absolutely necessary to determine beyond all doubt if any more perforations existed by repeating the rectal insufflation of hydrogen gas. On repeating this test it was found that gas escaped freely from the pelvic cavity, without reaching the ileo-cæcal region, showing that at least one more perforation was below this point. The sigmoid flexure was brought into the wound and compressed between the index finger and thumb. Insufflation was again followed by escape of gas, demonstrating that the perforation was below this point. Inch by inch the bowel was examined by this method in a downward direction, until a perforation was found in the anterior portion of the rectum at a point where the peritoneum covering its anterior wall is reflected upon the bladder. The perforation was rendered accessible to direct treatment by an assistant making traction on the colon and by keeping the margins of the wound well retracted by means of a pair of Hegar's retractors. It was closed by five Lembert sutures, with the greatest difficulty, on account of its deep situation and the inadequate light, which was furnished by two candles. From the perforations in the ileum there escaped pieces of green apples and intestinal contents, and from that in the rectum fluid fæces.

The peritoneal cavity was freely irrigated with a one-third of 1 per cent. solution of salicylic acid. After completion of the peritoneal toilet, a Keith's glass drain was introduced in such a manner that the distal open end was placed opposite the sutured rectal wound, and the abdominal incision closed in the usual manner. Whiskey was freely administered hypodermatically during the operation and after its completion, as the patient remained pulseless for half an hour. Time of operation two hours and a half. The foot of the bed was elevated and dry heat applied to the extremities.

Reaction was established slowly, but although the temperature did not rise much above normal, the pulse remained between 120 and 144 for two days, and during this time the patient was delirious. After the second day pulse and temperature nearly normal. The drainage tube was emptied every three or four hours by aspiration with a syringe, to the nozzle of which a piece of rubber tubing was fastened. Second day normal passage from the bowels. On the fourth day a fæcal fistula formed at the site of drainage, which closed ten days later.

The patient left the hospital completely cured six weeks after his admission, and has remained in perfect health ever since.

Remarks.—The subjective symptoms in this case four hours after injury, and after transport-

ing the patient a distance of six miles, furnished no indications whatever of the extent of the visceral injuries which were found and treated during the operation. The rectal insufflation of hydrogen gas at once rendered the diagnosis accurate and positive, and pointed out the necessity of abdominal section. Eleven perforations were found and sutured without much difficulty, but the last perforation, in the deeper portion of the pelvis, could not have been detected by any other means of diagnosis short of rectal insufflation. Had this perforation been overlooked, death from septic peritonitis would have been inevitable, as considerable fæces had escaped through the perforation into the peritoneal cavity.

Drainage was established in this case, not only on account of the fact that fæcal extravasation had taken place, but also for the reason that, owing to the difficulty in gaining access to the rectal wound, I feared that the suturing was not as perfect as it should be, and by proper drainage I wished to guard against possible extravasation into the peritoneal cavity. Subsequent events proved the necessity of this precaution.

Case 3. Perforating Gunshot Wound of Abdomen; four Perforations; Peritonitis; Laparotomy; Death.—J. E. (case of Drs. Gudden, Steele, and Gordon, of Oshkosh), eighteen years of age, was out target-shooting with a companion, who, while raising his 22-calibre rifle to his shoulder, accidentally discharged it; the bullet struck the patient in the abdomen. He was about forty feet distant, and almost directly facing his companion. When first seen by Dr. Gudden, within half an hour after the injury was received, he was suffering pain in the abdomen, was pale, covered with cold, clammy perspiration, and vomited frequently. He was placed in a carriage and conveyed to his home, a distance of two miles. During the journey, the severity of the abdominal pain was so increased by the motions of the carriage as to necessitate repeated stops.

I saw the patient, with the above-named physicians, October 9, 4 A.M., twelve hours after the accident.

Examination.—The wound of entrance was found to be at the outer margin of the left rectus muscle, about one inch below the level of the umbilicus. Abdomen dull on percussion in left iliac region, pulse 140, temperature 100° F. Penetration of the abdomen was proved by the introduction of a grooved director, which was left in place during the insufflation of the hydrogen gas.

The patient was placed under the influence of chloroform, and during the operation the narcosis was maintained with ether. The abdomen was thoroughly disinfected, and rectal insufflation of hydrogen gas practiced to ascertain if any perforation of the intestine existed. Under a pressure of about half a pound to the square inch, and the use of one-quarter of a gallon of gas, in a few minutes the gas escaped along the groove of the director, and, on applying a match, ignited as it escaped. The flame was now extinguished by a moist sponge, and the abdomen opened by a median incision, five inches in length, extending from the umbilicus to near the pubes.

On exposing the peritoneum at the lower angle of the incision, through this membrane there was observed a structure closely resembling an over-distended bladder. That this structure was a distended bladder was improbable, as the boy had urinated before the anæsthetic was administered. The peritoneum was carefully incised between two forceps and divided upon a grooved director to the same extent as the external incision, and it was then discovered that what appeared to be an over-distended bladder was a coil of small intestine distended with blood to twice its normal size. The whole pelvic cavity was found to be filled with fluid blood. On withdrawing the small intestine, five perforations, within a distance of three feet, near the junction of the jejunum and ileum, were found; four occurred in pairs on the lateral aspect of the bowel, and one at the mesenteric attachment. All the perforations were disproportionately large to the size of the bullet, and would easily admit the tip of the index finger. The intestine, at the point of injury, was covered with a thick layer of recent plastic lymph, and the parietal peritoneum presented all the evidences of a beginning diffuse septic peritonitis. The intestine, which was over-distended by blood-clots for about three feet, was emptied and irrigated with a one-third of one per cent. solution of salicylic acid, which was used for constant irrigation during the entire time required to suture the perforations, which were closed by Czerny-Lembert sutures.

Further examination disclosed four perforations of the mesentery, from two of which quite profuse venous hæmorrhage was still going on. The hæmorrhage was arrested by ligature *en masse*, by passing a needle, threaded with fine silk, through the entire thickness of the mesentery, on either side of the perforations.

Rectal insufflation of hydrogen gas was repeated, so as to ascertain if any other perforations existed, and the gas, after it had been gently forced beyond the highest perforation, was made to traverse the balance of the entire intestinal canal by drawing forward loops of the intestine and returning them as examined without further insufflation. This procedure was found entirely satisfactory and practical, as the gas, on account of its low specific gravity, readily entered the highest point in the prolapsed intestinal loop.

The abdominal cavity was irrigated with salicylic acid solution, numerous coagula removed, the toilet completed, a glass drain introduced into the pelvis, and the abdomen closed.

Duration of operation two hours. Patient col-

lapsed, pupils greatly dilated, and almost pulseless in spite of repeated hypodermatic injections of brandy, which were administered when signs of collapse became apparent, throughout the operation. Enema of a teacupful of warm water and two ounces of brandy. Foot of bed elevated and external dry heat applied.

In an hour and a half he rallied somewhat from the operation, but again sank and died at 3 P.M., eight hours after the completion of the operation.

Post-mortem eighteen hours after death (Drs. Steele, Gudden, and Gordon). Circumscribed peritonitis present at the time of operation, now diffuse; very little fluid in abdominal cavity; several small blood-clots in vicinity of transverse colon. The perforations were all securely closed, and the bullet was found in the soft tissues to the right of the spinal column, between the fourth and fifth lumbar vertebræ, and near the ascending colon. The bullet, though only of 22-calibre, was oblong, and may thus explain the unusually large size of the perforations.

Remarks.—This case, compared with the foregoing, furnishes a strong argument in favor of early operative interference in cases of gunshot or stab wounds of the abdomen in which the existence of visceral lesions can be demonstrated by rectal insufflation of hydrogen gas. In the first case, although twelve perforations were found and sutured, and fæcal extravasation had taken place, no evidences of peritonitis were found, and the patient recovered. In this case twelve hours intervened between the time the injury was received and the treatment by laparotomy, during which time a septic peritonitis had developed, the extension of which the operation did not arrest, and from the effects of which the patient died.

Case 4. Penetrating Gunshot Wound of Abdomen; Hydrogen Gas Test used with Positive Result; Laparotomy; Two Perforations of Ascending Colon; Death from Peritonitis on fifth Day.—This patient, a boy fourteen years of age, was shot in the abdomen by the accidental discharge of a 22-calibre rifle in the hands of his playmate, who was standing a few feet from him. The accident occurred September 23, 1889, at 5 o'clock in the afternoon. The physician who was first called probed the wound and ascertained that the bullet had entered the peritoneal cavity, and sent the boy at once to the Milwaukee Hospital for surgical treatment. No shock and no evidence of internal hæmorrhage.

Two hours later, after the necessary preparations had been made for laparotomy, the hydrogen gas test was applied, and as this yielded a positive result, the abdomen was opened at once. The wound of entrance corresponded with the umbilical depression, and from the position of the patient at the time the accident occurred and from the direction in which the bullet was discharged, I had reason to believe that the ball passed through the peritoneal cavity from the wound of entrance in a direction from left to right.

The abdominal cavity was opened by a median incision extending from the wound of entrance to near the pubes. A small quantity of hydrogen gas was found in the peritoneal cavity. The colon was moderately distended, and I had no difficulty in detecting a perforation about eight centimetres above the ileo-cæcal region. The visceral wound was on the same level with the parietal wound and on the side of the bowel towards the umbilicus. I expected to find the second perforation at a point opposite and on the same level, but the most careful examination failed to reveal its existence. I could find no extravasation or discoloration which would have assisted me in locating the second visceral wound, of the presence of which I was convinced.

To locate the second perforation I resorted to the following procedure: The colon was compressed above and below the perforation that I had found, and direct insufflation with hydrogen gas was made through the visceral wound. The gas escaped from behind the bowel, and the continued escape led me at once to the wound, which was located between the serous layers of the meso-colon and was completely hidden behind the anterior peritoneal layer. No fæcal extravasation was found before or after the insufflation. Nevertheless it was deemed advisable to flush the peritoneal cavity with warm sterilized water. After testing the remaining portion of the intestinal canal for additional perforations, the visceral wounds and the external incision were closed in the usual manner. A Keith's glass tube was inserted to secure drainage. The case progressed favorably for thirty-six hours, when evidences of diffuse septic peritonitis developed, which rapidly increased in intensity until the fatal termination, the fifth day after the operation. No post-mortem.

Remarks.—As the whole length of the gastro-intestinal canal was treated for additional perforations at the time of the operation, and none were found, we must take it for granted that the fatal peritonitis was caused by infection through the visceral wounds which were sutured, or through the operation wound, or possibly, the septic micro-organisms were conveyed into the peritoneal cavity by the bullet. The most interesting feature in this case is the procedure which was employed to discover the second perforation. The ordinary methods of examination proved utterly inadequate to discover the second visceral wound. Direct insufflation through the perforation which had been found, at once revealed the existence and location of the second visceral wound. Before the perforations were sutured, the colon below the wound was emptied of its gas, and the remaining portion of the gastro-intestinal canal was tested for additional perforations by direct insufflation through the anterior visceral wound.

This modification of the ordinary method of applying rectal insufflation of hydrogen gas in the diagnosis of perforations of the gastro-intestinal canal offers great advantages in that it prevents undue distension of the intestines, and when properly used renders it almost impossible to overlook a perforation sufficiently large to require direct surgical treatment. In cases of multiple perforations of the intestinal canal the lowest perforations can be readily located by rectal insufflation, but the remaining perforations should be pointed out by direct insufflation through the visceral wounds, taking the precaution to empty the sutured portion of the bowel of its gaseous contents, and after disinfection, if this becomes necessary, to return it into the abdominal cavity, thus preventing undue distension and extensive eventration.

Case 5. Penetrating Gunshot Wound of Abdomen; Inflation of Stomach and Colon with Hydrogen Gas; Foreign Body in Peritoneal Cavity; No Visceral Injuries Demanding Surgical Treatment. Recovery.—W. G., boy six years of age, was shot while he was standing on a box behind a saloon counter, the umbilicus reaching a little above the level of the counter. A bulldog pistol of 38-calibre was accidentally discharged at a distance of four feet from him. The bullet struck the counter to his left and in front, glanced, and penetrated the abdominal wall half an inch to the left of the linea alba and an inch and a half above the level of the umbilicus. After the shooting, the boy walked into an adjoining room without assistance, and the fact of his being seriously injured was only discovered on removal of his clothing. No shock. The patient complained of pain in the abdomen and vomited once, an hour and a half after the accident. The patient had eaten a hearty supper shortly before he was shot. No blood in the material vomited. Dr. Jürgens, the attending physician, applied a temporary antiseptic dressing over the wound, and administered small doses of morphia and atropia hypodermatically.

The accident occurred at 7 P.M., March 18, 1890, and on my arrival, seven hours later, his condition was as follows: Pulse 110 and full; face flushed, and although very quiet, complains of pain in the abdomen; liver dulness normal, both as regards location and extent. Wound of entrance plugged with omentum. The presence of omentum in the wound left no doubt that the bullet had entered the abdominal cavity, and from the location of the wound of entrance, and the probable course of the bullet from left to right and from below upward, I suspected that either the transverse colon or stomach had been perforated. Preparations were at once made for a laparotomy, so that in the event that the hydrogen gas test should yield a positive result the necessary operation should be done at once.

After the patient was thoroughly under the influence of chloroform, rectal insufflation of hydrogen gas was made, but when the colon had become fully distended it was discovered that the rubber balloon was leaking badly, consequently through insufflation could not be made. The insufflation of the colon, however, showed that this portion of the intestinal canal had escaped injury. The stomach was now inflated, and as this organ was fully distended without any leakage taking place, I was satisfied that no perforation existed. It still remained to determine whether the upper portion of the small intestine was injured, consequently an incision three inches in length, in the line of the wound of entrance, was made for the purpose of exploring the upper portion of the abdominal cavity for visceral injuries which might not have been revealed by the insufflations. A small shred of underclothing was found between the omentum and abdominal wall, near the track made by the bullet. After displacing the omentum upwards and to the left, a number of feet of the small intestine from the pylorus downward were examined with negative results. After a brief search, the bullet was found embedded in the space between the tenth and eleventh ribs on the right side, half way between the costal arch and the spine. The bullet was extracted through an external incision after pressing it outward with the index finger in the abdominal cavity. Only a small quantity of blood was found in the abdominal cavity. One external incision was closed in the usual manner, with the exception of a space for a small strip of iodoform gauze, which was inserted in the track of the bullet as far as the peritoneum. Ordinary aseptic dressing, retained in position by broad strips of adhesive plaster. The patient recovered promptly from the immediate effects of the operation, but soon dedeveloped symptoms of circumscribed peritonitis which lasted for a number of days, after which he recovered rapidly and completely. The external wound suppurated for a short time.

Remarks.—This case is of great interest, as it was demonstrated at the time of operation that the bullet had passed at least six inches obliquely through the upper portion of the abdominal cavity without inflicting any visceral injuries which required surgical treatment. The insufflations, although imperfect on account of a defective rubber balloon, proved of great value, as they made a direct examination of the stomach and colon for perforations unnecessary. The bullet undoubtedly passed between the transverse colon and the pyloric extremity of the stomach on its way from the point of entrance to the tenth intercostal space.

It is a comparatively easy task to find the perforations after the abdomen has been opened, if they are located in the small intestine, but perforations of the stomach and colon are often over-

looked during an ordinary examination, while their existence in these localities is promptly and infallibly revealed by insufflating these organs with hydrogen gas.

Case 6. Perforating Gunshot Wound of Abdomen; Through Insufflation with Hydrogen Gas Showing no Intestinal Perforations; Wound of Left Kidney; Expectant Treatment; Recovery.—S. W. A., thirty years of age, railroad conductor, was accidentally shot at 8 o'clock on the evening of April 3, 1890. The weapon used was a 22-calibre revolver. The physicians who were called were of the opinion that the bullet had entered the abdominal cavity, and advised prompt surgical treatment. An antiseptic compress was applied over the wound and morphia given hypodermatically. Almost immediately after the injury was inflicted the patient complained of a distressing pain in the region of the left kidney. No shock, or any other symptoms indicative of the existence of serious visceral injuries. Patient, accompanied by his physician, was transported on a cot by rail a distance of twenty-one miles, and arrived at the Milwaukee Hospital at 11:30 the same evening. At the hospital preparations had been made in the meantime for laparotomy.

Present Condition.—The wound of entrance was found near the tip of the cartilage of the seventh rib on the left side. The ragged opening, large enough to admit the little finger, was surrounded by numerous powder marks, showing that the shot was fired at very close range. Considerable emphysema in the immediate vicinity of the wound. Patient complains of pain in the wound and in the left lumbar region. Face flushed, pulse 90 and full; temperature normal. A small dose of atropia was given hypodermatically before chloroform was administered.

The abdomen and external wound were thoroughly disinfected. The track of the bullet was followed down to the peritoneal opening by an incision about three inches in length, which proved that the bullet had entered the peritoneal cavity. Under profound narcosis rectal insufflation of hydrogen gas was made. The colon became fully distended before the gas passed through the ileo-cæcal valve, showing that no perforations existed in this portion of the intestinal canal. The gas rushed through the ileo-cæcal opening with a distinct gurgling sound, after which the hypogastric region became prominent and tympanitic. The distension of the abdomen gradually ascending as the insufflation advanced, proved that the intestines were intact; finally, when the stomach became distended, an elastic tube was introduced, into the distal end of which a small glass tube was tied. As soon as the tube reached the stomach, gas escaped and was repeatedly lighted at the end of the glass tube. The hydrogen gas test had furnished positive evidence of the absence of intestinal perforations, and as there appeared to be no danger from internal hæmorrhage, it was decided to pursue a conservative course of treatment. The ragged, discolored tissues lining the track made by the bullet through the abdominal wall were carefully dissected out, and the wound united with buried and superficial sutures, leaving a small space in the lower angle for drainage.

After the completion of the operation a catheter was introduced into the bladder, and a considerable quantity of bloody urine escaped. It was now evident that the bullet had injured the left kidney and that it was probably lodged in the tissues behind the organ. As the patient did not show any evidence of internal hæmorrhage, I concluded to await further developments in reference to the treatment of the kidney injury.

The urine contained blood in gradually diminishing quantity for two days, after which it remained normal both in quality and quantity. No untoward symptoms appeared, and the patient was fully convalescent and left the hospital two weeks after admission. He has since followed his occupation, and has suffered no inconveniences whatever from the presence of the bullet in the lumbar region.

Remarks.—The hydrogen gas test in this case proved a perfect success, as the through insufflation demonstrated in a most positive manner the absence of intestinal perforations. The bullet must have passed between the cardiac extremity of the stomach and the splenic flexure of the colon on its way through the abdominal cavity to the left kidney. Without the hydrogen gas test it would have become necessary to make an abdominal section and examine the whole length of the gastro-intestinal canal in order to show that no perforations were present, a procedure which might in itself have proved a cause of death.

The belief is almost general that a gunshot wound of the kidney should be treated by nephrectomy. In this case I decided to pursue an expectant plan on account of the small calibre of the bullet, the absence of symptoms indicative of serious internal hæmorrhage, and the existence of only a moderate hæmaturia. It was my intention, in case the injury of the kidney should result in a suppurative inflammation of this organ or its surrounding tissues, to make subsequently a lumbar nephrotomy or nephrectomy.

Objections to the Hydrogen Gas Test.

Like all other departures from the old and time-honored methods of diagnosis and treatment, the use of the hydrogen gas test in the discovery of visceral lesions of the stomach and intestines in perforating gunshot wounds of the abdomen will have to run the gauntlet of adverse criticism until, after a more extended experience in the hands of different surgeons, its merits will more generally be recognized. The principal objection, and the

one that has so far been mentioned most frequently, is that:

1. Rectal Insufflation of Hydrogen Gas in the Diagnosis of Perforating Gunshot Wounds of the Abdomen Increases the Danger from Fæcal Extravasation.—The small intestines, even during active digestion, contain only a limited quantity of chyle, and in the numerous experiments on animals I have never observed that the gas forced out through the perforations any of the fluid or solid intestinal contents. Any one who has observed the process of inflation *ad oculum* will understand why it does not produce extravasation. Hydrogen gas being of much lower specific gravity than the fluid intestinal contents, lifts the distended intestinal loop to the highest possible *niveau* compatible with the mesenteric anchorage of the bowel; hence when the gas reaches a perforation, that portion of the intestine occupies a higher plane than the adjacent portions of the intestine, and the chyle by its own weight seeks a lower level, leaving the perforated part of the bowel empty of its normal contents as long as it remains distended with the gas. A number of experiments were made for the special purpose of showing that the fear of fæcal extravasation taking place on applying the hydrogen gas test in the diagnosis of visceral wounds of the gastro-intestinal canal is unfounded. This will be shown most conclusively by the few experiments which I will detail briefly below.

The dogs used in these experiments had all had a full meal from three to four hours previously. Immediately after they were killed the abdomen was opened, and wounds corresponding in size with wound made by a 22-calibre bullet were made in different parts of the intestine before rectal insufflation was commenced.

Experiment 1. Duodenum. — Three wounds were made in this part of the bowel some distance apart, one on the free or convex side, one on the mesenteric side, and the third on the side at a point half way between the free and mesenteric borders. In a few seconds after the insufflation was commenced the gas had ascended as far as the duodenum and escaped from all the openings freely without causing a drop of extravasation, although this portion of intestine contained a considerable quantity of fluid at the time.

Experiment 2. Jejunum.—Three openings were made in this part of the small intestine large enough to insert the tip of the little finger. The perforations were diminished in size, but not closed, by bulging of the mucous membrane. The gas reached the perforations after moderate distension of the intestine on the distal side, and escaped freely from all the perforations without causing a trace of extravasation.

Experiment 3. Ileum. — Similar experiment with same result.

Experiment 4. Cæcum. — An opening large enough to insert the tip of the little finger was made in the anterior wall of the cæcum, and although this part of the bowel contained liquid fæces, the gas did not force out any of the contents.

Experiment 5. Ascending Colon.—In this experiment the opening, similar in size, was made on the side of the bowel, but the escaping gas caused no extravasation.

Experiment 6. Transverse Colon.—Same experiment with same result.

Experiment 7. Sigmoid Flexure. — Lateral perforation large enough to correspond with a wound made with a 38-calibre bullet through which gas was forced by rectal insufflation, but no fæces escaped. Fæcal extravasation occurred when the bowel was compressed above the perforation and the insufflation was continued.

These experiments only corroborate my observations made in over a hundred perforating gunshot wounds of the abdomen in dogs, and my clinical experience that the distension of wounded intestines with hydrogen gas does not increase the danger from fæcal extravasation. The escape of solid fæces through a perforation by insufflation of gas is not to be expected, as the gas will pass between the solid mass and the intestinal wall, lifting the perforation away from the intestinal contents.

2. Rectal Insufflation of Hydrogen Gas does not Infallibly Demonstrate the Existence of Visceral Wounds of the Stomach or Intestines.—I have already stated that the hydrogen gas test has proved infallible in my hands, both in my experimental work and in the six cases which I have reported in this paper. There are two conditions under which hydrogen gas might pass the whole length of the gastro-intestinal canal without indicating the existence of a perforation:—(*a*) Plugging of the opening by a foreign body; (*b*) The perforation may be too small for the escape of the gas.

(*a*) *Plugging of Perforation by Foreign Body.* —Failure of the test from this source could only take place in exceptional cases, as when the stomach is wounded soon after the ingestion of a meal. A case has been reported where the stomach contained coarse solid food, in which the test resulted negatively. The patient died and the post-mortem showed that the perforation was closed by grains of rice which the patient had eaten shortly before he was shot. It is impossible to say whether in this particular case the foreign substance was driven into the opening by the bullet, or whether it was forced into it by the inflation. To prevent the latter occurrence in gunshot wounds of the stomach it is absolutely necessary to either evacuate the stomach by an emetic shortly before the test is applied, or to place the patient in such a position during the inflation that the wound in the stomach will occupy the highest level, as when this is done the hy-

drogen will lift the perforation away from the solid contents and thus effectually prevent plugging of the perforation. If the location of the probable wound is not known, the patient should be placed alternately in different positions during the insufflation. If, from the course of the bullet it is probable that the stomach has been wounded the inflation should not be made *per rectum*, but directly through a stomach tube, as inflation of this organ can be made more effectually by this direct method.

There is absolutely no danger that mechanical closure of the perforation by the impaction of a foreign body will ever interfere with the reliability of the hydrogen gas test in gunshot wounds of the intestines.

(*b*) *Small Size of Perforation.*—In every case of gunshot wound of the stomach or intestines, the size of the perforation is diminished by eversion of the mucous membrane which either partially or completely plugs the opening. The permeability of the perforation will not only depend on the size of the opening, but it is also influenced by the thickness of the wall of the organ at the seat of injury. The wall of the intestinal canal diminishes in thickness gradually from the stomach downward to the ileo-cæcal region. A bullet wound of the stomach of the same size as one in the lower portion of the ileum will be more securely closed spontaneously by prolapse of mucous membrane, and will consequently be less likely to be permeable to the escape of gas when insufflation is practiced.

I made an extensive series of experiments on dogs with missiles of small calibre, both for the purpose of determining the size of perforation which makes laparotomy necessary and also to ascertain the size of the visceral wound which will permit the hydrogen gas to escape into the peritoneal cavity when insufflation is made for diagnostic purposes. In reference to the first point my experiments demonstrated conclusively that the size of the missile is absolutely no indication of the size of the perforation. I used missiles varying in size from a No. 8 shot to a 22-calibre bullet. Cartridges containing an ordinary charge of powder were loaded with from four to twelve shot and the shooting was done with an ordinary 12-gauge single barreled shot-gun at a distance of ten feet, with the dog strapped upon a table and placed in erect position, and the umbilicus for a central mark. Shot of all sizes invariably penetrated the abdominal wall and passed through the peritoneal cavity. A record was kept of the exact location of the wounds of entrance and of the number of shots which entered the peritoneal cavity in each case. A number of the animals died within half an hour to two hours after the shooting and the necropsy invariably revealed hæmorrhage as the immediate cause of death, the shot having injured some of the large abdominal vessels or vascular organs, as the spleen, liver or kidneys. Death from this cause occurred less frequently if shot of fine calibre was used, yet in several instances it was found that No. 8 shot, which are not larger than a mustard seed, caused death from hæmorrhage when the inferior vena cava or one of its large branches was injured.

A number of dogs recovered without treatment after having been shot transversely through the abdomen with a 22-calibre conical bullet. These animals were killed from one to several weeks after the shooting, when from one to four healed perforations were found. The point of perforation always presented the same characteristic appearance, a nipple-like elevation on the serous surface and a corresponding conical depression on the mucous surface. What occurred in these cases was temporary closure of the perforation by plugging of the visceral wound with mucous membrane and the formation of a cover of new tissue over the apex of the prolapsed mucous membrane. Dogs that were wounded with shot finer than No. 4 seldom died from the effects of the visceral injuries, and some of these animals were shot three different times at intervals of one to two weeks, producing in this way dozens of minute perforations in different portions of the gastro-intestinal canal, all of which healed without surgical or any other treatment. In the animals that died from the visceral injuries the necropsy always showed the existence of perforations larger than are ordinarily produced by a 22-calibre bullet. These large perforations were either caused by two shots passing in close proximity through an intestinal loop making one common wound, or they were the result of a laceration caused by the shot grazing the convex margin of an intestinal loop. In this manner I have seen a No. 2 shot tear an opening in the bowel large enough to insert the tip of the index finger.

The next object in this series of experiments was to determine the size of the smallest wound of the stomach or intestines which could be discovered by means of the hydrogen gas test without opening the abdomen. The test was applied in perforating wounds of the abdomen inflicted with shot varying in size from No. 8 to "B.B.," the latter of which corresponds with an 18-calibre bullet. Rectal insufflation was practiced immediately after the shooting. All animals in which the hydrogen gas test gave a positive result died, that is, if the gas escaped either through one of the perforations in the abdominal wall, or if it escaped into the peritoneal cavity in sufficient quantity to be recognized by physical symptoms, such as free tympanites, as nothing was done in the way of treatment in all of these cases. The post-mortem invariably showed a perforation or laceration of the intestines or stomach too large to become temporarily closed with a plug of mucous membrane; hence infection of the peri-

toneal cavity and death from septic peritonitis followed in from one to three or four days.

In the animals in which the test resulted negatively, and these included some in which shot of large calibre were used, peritonitis did not ensue, and if hæmorrhage did not prove a source of danger, they recovered without any untoward symptoms.

This to me proved an object of great interest and far-reaching practical value, as it satisfied me that the hydrogen gas test can not only be relied on when it is necessary to interfere in cases of perforating gunshot wounds of the abdomen, but that it also furnishes the only safe and positive indication for non-interference.

In all cases where the test resulted negatively, the insufflation was continued until the gas escaped from the elastic tube which was inserted into the stomach, and the presence of the escaping gas was demonstrated by lighting it at the end of the tube. I have frequently had opportunities to observe that perforations made with a 18-calibre shot were impermeable to the insufflation and that occasionally considerable force had to be used to make the gas escape through a wound made with a 22-calibre bullet. These are the perforations which will heal spontaneously and through which infection of the peritoneal cavity is not likely to occur, because escape of the gaseous and liquid contents of the intestines does not occur.

3. The Hydrogen Gas Test Renders Reduction of Intestines after Laparotomy more Difficult or Impossible.—This objection can only apply to cases of wounds of the stomach or of the upper portion of the small intestine. I have already insisted that when, from the course of the bullet, we have reason to believe that the stomach has been injured, this organ should be inflated directly through an elastic tube and not by rectal insufflation. If the test results positively, the indication for a laparotomy has been furnished; if otherwise, the nearest hollow organ, the colon, is examined for perforations by rectal insufflation. In the absence of perforations below the ileo-cæcal valve, the insufflation is extended as far as the stomach, and if the result is positive and the perforation is located high up in the intestinal canal, the intestines below the first perforation will be found moderately distended upon opening the abdomen. After the last perforation has been found, much of the gas can be evacuated through this opening. By resorting to Kümmels's method of replacing the intestines, no difficulty is experienced as a rule in this step of the operation. In all of my cases, and in all of my experiments I have invariably succeeded in replacing the intestines without much loss of time and without doing any damage. If high insufflation has been made and if after suturing all of the perforations, any difficulty should be experienced in replacing the intestines, there should be absolutely no objection to making a small incision into one or more of the most distended loops of the inflated intestine and after evacuating the gas closing then by one or two superficial sutures.

4. Hydrogen Gas Test is Unnecessary.—It has been asserted that the hydrogen gas test is superfluous because every perforating gunshot wound of the abdomen is necessarily complicated by visceral injuries which require treatment by laparotomy. This objection to the use of the hydrogen gas test has already been disposed of, as I have shown experimentally and clinically that in a fair percentage of cases of perforating gunshot wounds of the abdomen the bullet inflicts no serious visceral injuries, and that such cases will recover, as a rule, without laparotomy.

It has also been stated that the use of the hydrogen gas test is unnecessary in detecting the perforations after the abdomen has been opened, as it is claimed that the perforations could be readily found by examining the intestinal loops lying in the course of the bullet. The adoption of this advice could not fail to lead to frequent errors of diagnosis and disastrous results in treatment, as the injured part of the bowel changes its relative position in the abdominal cavity very soon after the injury has been inflicted. This is especially true of that portion of the small intestine supplied with a long mesentery.

In order to show that a perforated intestinal loop will in a short time wander away from the place it occupied when struck by the bullet, I made the following experiments:

Experiment 1.—Medium sized male dog. The abdomen was opened by a median incision, exactly four inches in length; the omentum pushed to the left of the median line and sutured to the left margin of the abdominal wound. The intestines being disturbed as little as possible, two points of intestine corresponding exactly to the upper and lower angles of the incision were marked by drawing a black thread through the serous coat which was loosely tied and cut short. The external incision was sutured and the dog was killed eighteen hours afterwards. The wound was found firmly agglutinated and the omentum adherent to the incision. Enlarging the incision and leaving the intestines undisturbed, the upper marked loop of the intestine was found displaced two inches to the right of the median line and one inch and a half downwards and backward, being also covered by another intestinal loop, and the thread being directed toward the spine. The lower marked point was found one and one-half inches to the left, and one and one-fourth inches downwards, behind the bladder with the thread also directed towards the spine.

In the three subsequent experiments, the ab-

dominal incision was made fully six inches in length and the omentum was left undisturbed, and in the middle line two loops of the intestine, four inches apart, were marked, one with a white, and the other with a black thread which were passed through the serous coat and loosely tied. The intestines were exposed by a rent in the omentum four inches in length. On the margin of the abdominal incision a small tranverse cut in the skin was made to indicate the exact position occupied by the marked intestinal loops.

Experiment 2.—Large female dog. Experiment described as above. Animal killed after twelve hours. Abdomen opened by incision from sternum to pubes and transversely at level of umbilicus. The lower marked loop was found displaced upwards three inches, and half an inch to the right of the median line. Thread in same direction as when introduced. Upper loop displaced downwards two inches, thread directed laterally, covered by another loop of intestine.

Experiment 3.—Large male dog. Killed six hours after marking position of intestinal loops. Examination showed that the marked points were transposed, upper loop now being the lower, displaced four inches downwards and half an inch to the left of the median line. Lower loop displaced two inches upwards and buried underneath two layers of intestinal coils.

Experiment 4.—Large female dog. Killed two hours after opening the abdomen. Upper marked point displaced an inch and a half downwards and an inch to the left of the median line, and covered by a loop of intestine; lower loop displaced one inch downward, and was pushed half an inch to the left of the median line.

These experiments show conclusively that in making laparotomy for perforating wounds of the abdomen, the wounded intestinal loops are seldom found in the position they occupied the time they were hit by the bullet. Even two hours after the injury an intestinal loop perforated when it occupied a place corresponding with the level of the umbilicus may be found in the cavity of the pelvis, or several inches above and to the left or right of the median line.

The hydrogen gas test is of the greatest value in locating the perforation after the abdomen has been opened, as without it, one or more perforations may be overlooked and become a cause of death in cases that might have recovered had the perforations been discovered and sutured. From the inaccessibility of the duodenum perforations of this part of the intestinal canal are very liable to be overlooked. Two cases have recently been reported where this occurred. Bernays, of St. Louis, made a laparotomy for perforating gunshot wound of the abdomen, sutured several perforations, and overlooked, as the post-mortem showed, a large perforation of the duodenum.

The second case is related from the clinic at Basle. A man was brought into the hospital with a penetrating stab wound of the abdomen. The wound was enlarged sufficiently to permit of eventration. Inch by inch the small intestine was examined, but no perforation was found. The man died of septic peritonitis two days later. The post-mortem revealed a wound of the duodenum over an inch in length which had been overlooked, and which was the direct cause of the peritonitis and the indirect cause of death. It is needless to say, that had the hydrogen gas test been applied in these cases before or after the abdomen was opened, the perforations would have been discovered and sutured, and in all probability, both patients would have recovered.

In all cases of perforating gunshot wounds of the abdomen the whole length of the gastro-intestinal canal should be tested by ballooning the stomach and intestines before the abdomen is closed, in order to guard against the possibility of leaving an undiscovered perforation.

(*To be concluded.*)

MEDICAL PROGRESS.

THE ANTISEPTIC VALUE OF ANILIN (PYOCTANIN MERCK'S).—DR. O. PETERSON (*St. Petersburger Med. Wochenschr.*) adds his experience with this drug to the not inconsiderable literature that has accumulated since the appearance of Stilling's brochure early in the current year. The substance was obtained directly from Merck, and consisted of pencils of violet and yellow anilin, a powder containing 2 per cent. solutions 1:2000, 1:1000 and 1:100. The observations were made in the ambulatory and in the Alexander hospital, as well as in private practice. The remedy was employed in 42 cases, presenting soft chancre 20, indurated 8, syphilitic ozena 4, gummatous ulcers 5, ecthyma syphiliticum 1, keratitis 4, blennorrhœa 1, conjunctivitis 1, after circumcision 4. Dr. Peterson devoting special attention to syphilis, has used the drug largely in cases where iodoform has formerly been employed, in all these cases he has had equally good results without the unpleasant odor that at times prevents the use of this drug. Especially in soft chancre were excellent results noted, and these were compared with a series of similar observations upon aristol, and iodide of bismuth. The latter drugs worked with much less energy than pyoctanin and the results were not favorable.

Especially good results were observed in syphilitic ozena accompanied by a foul discharge. The entire mucous membrane of the nose was penciled with a 1 per cent. solution. After three or four days the fetor disappeared and healing took place.

The article closes with the statement that

the drug has marked antiseptic properties and is equally useful in septic as well as aseptic wounds. It is useful in eye diseases as well as in venereal sores. Toxic or unpleasant symptoms have not been noticed up to the present. Further observations are earnestly desired, as the drug has a considerable range of application and may prove of great value.

BROMOFORM IN WHOOPING COUGH.—H. NEUMANN (*Therapeutische Monatshefte*, July, 1890) describes the results obtained in treating 61 cases of pertussis with bromoform. The dose, from one to three drops suspended in sweetened water, was continued from several days to two or three weeks. The results in most cases were favorable in that there was a diminution in the number, as well as the severity of the seizures. In some cases it seemed to lessen the length of the disease. The bromoform is readily taken by children as the taste is not unpleasant, and in no case were unpleasant symptoms noted from the use of the drug.

Neumann also refers to the pleasant effect of small doses of phenacetin in this condition. He employed this drug in nine cases with excellent effect.

He closes this article with the statement that the therapeutics of pertussis is still symptomatic as the drug has not yet been discovered that will destroy the germs of the disease and thus stop an attack in its incipiency. But we do have drugs that affect favorably the inflamed mucous membrane, or lessen reflex action, and with these we can reach an individual and symptomatic treatment of the disease, which will greatly lessen the gravity of the symptoms. From this point of view a further study of the remedies for whooping cough is recommended until such time as the specific drug presents itself.

NINE CASES OF UTERINE MYOMATA TREATED BY APOSTOLI'S METHOD. — F. ENGELMANN. (*Deutsche Med. Wochen.*, July 3.)—These cases were taken unselected from a number which regularly visited Kreuznach for its curative regimen, and included patients rather well situated in life, and in whom a host of other procedures had been tried with varying success. The treatment in all cases was adopted only at the suggestion of the patients, who had heard of Apostoli's method and results. From the result of his experience with this treatment, E. makes the following conclusions: 1. Involution of the growth, evidenced by diminution in its bulk, could only be positively demonstrated in isolated cases, and was not considerable. 2. The principal effect of the electrical treatment was upon the diseased mucous membrane; it was in all cases brought to a nearly normal state, and the symptoms induced by it—bleeding, fluor albus—favorably influenced or entirely removed. 3. Favorable effect upon the symptoms of compression could always be obtained as well as improvement in nervous symptoms. 4. The treatment as a whole, does not accomplish more than methods heretofore in vogue; but it should still be regarded as a valuable adjunct to our armamentarium against uterine myomata.

The apparatus used by the author was a 24-cell portable modified Leclanché battery, which Apostoli had highly recommended to him. In all his manœuvres he had followed exactly in the wake of the Parisian master. Much valuable aid was derived from a galvanometer graded to 250 milliampères. He considers a rheostat superfluous. The external clay electrode as recommended by Apostoli was found the most serviceable, after using all the modifications vaunted by the various authorities. The patients all said that they experienced the least pain from the clay electrode. He used only platinum needles for electro-puncture, in no case steel ones. The latter are cheaper and sharper, but cannot be used when the anode is to be brought into action. Needle and sound should always be introduced without a speculum, to gain the certainty afforded by the controlling finger. The author was surprised by statements that currents of 200 and 250 milliampères could be safely used. In most cases he could not go over 150 or 160 milliampères, frequently not so high. He was not able to note a diminution in the pulse rate during the sittings. The most frequent symptom next to pain —which was never very great—was a not unpleasant sensation of fatigue, in one case increasing to somnolence. Apostoli and others lay great stress upon the importance of patients taking an hour's rest after the application, and then to go home in a conveyance. This precaution is especially recommended after electro-puncture. The author found this an unnecessary precaution. He repeated the applications every other day. He believes that he might have had more success if he could have protracted the treatment. At the same time he treated two cases constantly for six months without achieving anything as regards the diminution in the size of the growth. Pain was in all cases favorably influenced by the electrical treatment, in one case with astonishing promptness. The constipation which generally existed was uniformly removed. The general condition of the patient was remarkably bettered. —*Am. Jour. Obstetrics.*

EARACHE.—Take five parts of camphorated chloral, thirty parts of glycerine and ten of sweet almonds. A piece of cotton is saturated and introduced well into the ear, and it is also rubbed behind the ear. The pain is relieved as if by magic, and, if there is inflammation, it often subsides quickly.

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LONDON OFFICE, 57 AND 59 LUDGATE HILL.

SATURDAY, SEPTEMBER 6, 1890.

THE ANILIDES IN PUERPERAL FEVER.

Antipyrin, antifebrin, exalgine and similar drugs are used extensively in the systemic treatment of puerperal fever. They are employed chiefly to combat pyrexia. Of the fact of the widespread use of these agents in childbed fever, we are convinced from numerous allusions in the medical press and from sufficient personal observation.

This therapy is most extraordinary, when we consider the blood changes in septicæmia, the imperfect state of our knowledge as regards the exact physiological action of the anilides, and the number of mishaps that have already occurred as a consequence of their use.

Passing over the researches of PANUM, the school of ALEXANDER SCHMIDT and others, as regards the destructive effects of "putrid poison" on the form elements of the blood, we come to the results of the investigations of modern bacteriology. KOCH writes: "The comma bacilli are able to exert a destructive influence on form elements of the blood, probably also on other cells." SCHEURLEN has shown that the sterilized, inspissated product of metabolism of the *staphylococcus aureus* makes the blood the color of lac-dye and dissolves the corpuscular elements, an observation confirmed by BEHRING. Further, these ptomaines have the property of immediately destroying hæmoglobin. BUCHNER and NISSEN have proved that while normal blood possesses a germicidal power, this ability is readily lost. Buchner writes: "Blood is without effect in the destruction of bacteria after one hour's elevation to a temperature of 55°, as already found by Nissen. In such blood, the increase of the disseminated bacteria begins at once. The blood has become a culture medium. And at the same time, solution of a large portion of the red blood corpuscles occurs." GOTTSTEIN'S[1] experiments tend to show that the destruction of the red cells in circulating blood has a similar effect in the inhibition of any germicidal action. The chief conclusion of his very interesting investigation is as follows: "Certain bacterial products, especially those of putrefaction, possess the property of destroying red blood corpuscles. A destruction of the red corpuscles, that inhibits germicidal action in defibrinated blood, also effects in the living organism such a lowering of resistance, that bacteria, that have no, or only local pathogenic properties for the particular organism, now attain the ability to stick securely in external wounds, and to increase within the circulation to the degree of septicæmia." In his experiments upon rabbits, guinea pigs and mice, in addition to the injection of the bacteria of splenic fever and chicken cholera, he used hydracetin (acetylphenylhydracin), pyrogallic acid and other blood poisons. The most striking case was that of guinea pigs injected with chicken cholera. These animals infected with chicken cholera, and injected with hydracetin in not deadly doses, died of septicæmia, while other animals subjected simply to the subcutaneous injection of the chicken cholera remained entirely immune. In this connection Gottstein remarks that in all fevers dependent upon septic conditions great caution is demanded in the exhibition of those remedies that injure the cellular elements of the blood.

Now, as before remarked, our knowledge of the exact physiological action of the anilides is very imperfect, but the weight of evidence, collected from observation and experiment, is very much in favor of the view that these agents, even in small doses, are liable to affect the form elements of the blood. Antipyrin, according to LÉPINE, produces "in dogs trembling, apathy, weakness and fall of temperature, with loss of excitability of peripheral nerves. The arterial blood became, in some cases, of a dirty brown color, loaded with methæmoglobin; the corpus-

[1] "Beiträge zur Lehre von der Septicæmia," Deutsche Medicinische Wochenschrift, No. 24, 12 Juni, 1890.

cles were said, however, to be unaltered either in number or shape, and the serum was not tinged. Analysis of the gases of the blood showed great deficiency in oxygen. Large doses depressed the heart action." Exalgine, according to BINET, produces similar blood changes in cats and rabbits, together with much salivation. Cyanosis is a marked symptom of poisoning by aniline, the base from which all these bodies are derived.

In human beings, however, hæmoglobinuria has been recorded as a symptom of antipyrin poisoning, and there is evidence to show that the anilides, not necessarily in large doses, do affect the integrity of the blood. For the details of two remarkably clear cases of poisoning by anilides in small doses (exalgine and antifebrin), we beg to refer our readers to an excellent paper by T. JESSOP BOKENHAM and E. LLOYD JONES, that appeared in the *British Medical Journal* of February 8. Among the symptoms in these cases, were cyanosis, great dilatation of blood-vessels, small, regular, compressible rapid pulse. Urinary changes were not observed.

In the light of all the evidence, it is impossible at present to justify the exhibition of the anilides in puerperal fever. Indeed, in view of the effect upon the blood and circulatory apparatus, it is even in order to question the propriety of using these drugs in the alleged mitigation of the pain of parturition. We advisedly employ the expression, "alleged mitigation," since up to the present, the reports as regards the analgesic value of the anilides in labor, while contradictory, yet indicate an uncertain, and very limited power.

The anilide treatment of puerperal fever receives its severest condemnation, when it is remembered that for years the profession has been in the possession of a highly successful plan of treatment, and that after all, the use of these dangerous artificial drugs is a work of supererogation. As systematized some years ago by MAX RUNGE, this plan consists chiefly in the administration of maximum quantities of food and alcohol, combined with spongings with cold water.

Within the past six months, an example of sapræmia has come under our personal observation, in which the inhalation of oxygen apparently effected an immediate and permanent reduction of pyrexia. The gas was exhibited some hours after adequate local disinfection. Certainly, this agent is harmless, and there is presented in the researches of GOTTSTEIN an eminently rational indication for its use. If certain blood poisons, like hydracetin and the anilide reduce the physiological resistance of the blood, and so favor the increase of bacteria, why may not oxygen augment the germicidal action of the blood?

THE AMELIORATION OF LEPROSY IN INDIA.

The careful consideration that leprosy in India, especially, is receiving by special commissions and other agencies in Great Britain, has already brought about marked improvement in the condition of many patients. The two leading thoughts, at the present time, appear to be, first, the home repression of vagrancy among lepers, and, second, the protection of the children of lepers. These commend themselves to us as very practical and practicable first steps toward the prophylaxis of the disease. A bill has been drawn up, designed to establish governmental retreats into which the vagrant class shall be gradually gathered, and in which the sexes shall be separated. In many places, in India, no lazarettoes of any kind exist, and are not only much needed for the protection of the natives from the roving lepers who spread the disease, but also for the comfort and keeping of the lepers themselves. Next in importance arises the question of the care of the children, not yet infected, of leprous parents. It has been pointed out by DR. MONRO, a careful student of this question, that "leprosy has never been proved to be transmitted without contact, and is not constantly transmitted to their families, even when both parents are diseased, and it seldom affects more than one child in the same family." SIR MORELL MACKENZIE has expressed the opinion that the hereditary transmission has scarcely any existence. It is, nevertheless, highly important to take away from these children the risk of contagion, and for this purpose a few homes have been established, in connection with existing asylums for adults. A society in Scotland is actively exerting itself in this direction; but it must, of course, be a labor of many years before the ground can be thoroughly covered. The medical care of lepers, the questions of nursing, diet, and the treatment of the many distressful symptoms of the disease, have been the means of undoubted bene-

fit to many hundreds of cases that have been brought within the reach of the medical missions and other retreats of European and American origin.

IS DIDACTIC TEACHING LOSING GROUND?

The part played by the eloquent lecturer, in our medical curriculum, is designed to greater desuetude, if the indications that come to us from abroad are any criterion. The General Medical Council of Great Britain has recently taken action which will serve for a milestone, for many a year; it is virtually a rebuke to all those that place the restrictions upon graduation if they continue to exact a large number of attendances upon didactic teaching. The s perabundance of systematic lectures is out of proportion to the requirements of the present age, as will be seen by the resolution adopted by the General Council, as follows: "That regulations requiring attendance on systematic courses ought not to exceed a demand for more than *two or three* lectures weekly *in any one course*, nor for an attendance upon more than *two or three lectures in any one day*." The ability of the modern student to sit all day in the lecture-room is challenged, and this new doctrine will, it is said, be an especial relief to the students in the Scottish universities, where the hold of the lecturer, as the chief means of imparting instruction, still remains a strong and dominant one. SIR JOHN SIMON, one of the Council, remarked that it was absurd to require a student to attend lectures on subjects which might be equally well, if not better, learned from the text-books. And DR. MITCHELL BANKS observed that the Scotch lecturer appeared to be a sort of man-eating tiger amongst the lecturers; and he had heard of persons being preached to death by wild curates, but an even greater catastrophe would be to be lectured to death by Scotch professors, a fate which he himself, thanks to a naturally robust constitution, had narrowly escaped. The advocates of this action in the Council were not so much in favor of shortening the actual time given to the required subjects, but of allowing the professor to substitute for lectures other and more practical means of imparting knowledge, and to give time to class examinations and laboratory work.

EDITORIAL NOTES.

STORIES OF A COUNTRY DOCTOR.—This clever volume by Dr. Willis P. King, formerly president of the Missouri State Medical Association, is true to its title, and has the advantage of suitable illustration. It contains nearly four hundred pages, issued from a printing house in Kansas City. This book will commend itself to the profession, above the few others of its class that have been attempted in this country, because of the keen observation, joined to a subtle sense of humor, possessed by its author, who is able with dignity and friendliness to give an insight into the curious corners of rural experience. It must have required no little courage on the part of Dr. King to publish these recitals, but he has proved himself the master of the situation and may expect good degree of success and solid returns.

THE PHILADELPHIA COLLEGE PRIZE AWARD.—The Alvarenga prize of the College of Physicians of Philadelphia, consisting of one years' income of the bequest of the late Dr. Alvarenga, of Lisbon, has been awarded to Dr. R. W. Philip, of the Victoria Dispensary for Consumption at Edinburgh, for his essay on pulmonary tuberculosis, which will presently be published by the College.

BUBONIC PLAGUE IN TURKEY.—The *New York Medical Journal*, quoting from the *British Medical Journal*, announces that the Imperial Sanitary Board of Turkey, has information of an outbreak of the plague at Kale-Daragehan, a village of 280 inhabitants, and that forty-two persons have been attacked, with twenty-six deaths already. The reporter of the cases, Dr. Constantinides, personally observed many of the patients. He states that the disease is marked by inguinal, axillary, and retro-auricular buboes, with a temperature of 104° F. and a bluish cutaneous rash.

A NEW MEDICAL JOURNAL.—The first number of *The Journal of the State Medical Society of Arkansas* is just received. At the last annual meeting, in answer to a recommendation of President Orto in his annual address, a committee was appointed to report upon the advisability of publishing the proceedings of the State Medical Society in the form of a monthly journal. The committee, consisting of J. M. Kellar, D. C.

Ewing, and L. P. Gibson, reported in favor of such action, and as the result of its adoption by the Society, the first number of the journal is presented to the profession under the editorial supervision of Dr. Lorenzo P. Gibson. It is published solely in the interests of the Society, and has no other business relation. Each number will contain forty-eight pages of reading matter, and will command the services of a number of medical men who can well represent the Southwest in the field of medical journalism. Its financial success is already assured. We welcome it to our list of exchanges and bespeak for it a successful career.

OBSTETRICS AND GYNECOLOGY.—The American Association of Obstetricians and Gynecologists will hold its next annual meeting in the hall of the College of Physicians in Philadelphia, September 16, 17 and 18, 1890. E. E. Montgomery is President and William Warren Potter Secretary. A general invitation to all physicians interested in these specialties is cordially extended to attend the several sessions.

SURGEON-GENERAL BAXTER.—Colonel Jedediah H. Baxter has received the appointment of Surgeon-General of the U. S. Army, the nomination by the President having received the unanimous concurrence of the Senate. His father, Portius Baxter, formerly represented his State in Congress. Surgeon Baxter was born in Vermont in 1837. He is a graduate of the Vermont University. He entered the Army as Surgeon in the Twelfth Massachusetts Regiment of Volunteers in 1861. From that date to this he has been in continuous service, at all times holding positions of prominence and responsibility. He was appointed Chief Medical Purveyor by General Grant in 1872, which position he has held up to the date of this last promotion. His able and continuous service in the Army for nearly thirty years receives a fitting recognition, as the highest honor in his department in the gift of the nation is thus conferred upon him.

THE VALUE OF INTERNATIONAL CONGRESSES.—The Tenth International Congress at Berlin came to a successful closing, and its volumes of Transactions will bear witness to the value of the contributions there made. The special practical advantages to be derived from such international gatherings lies not so much in special work there accomplished. The press, rather than the forum, is more serviceable in the promulgation of scientific truths; but the opportunity thus presented for the meeting of men of note, face to face, is one which will lend inspiration to their future efforts, and will give them an added value. Such meetings beget a world-wide interest in all medical questions; they develop a brotherhood of the profession; they broaden and strengthen the great work of scientific investigation which must be incident to medical progress. The profession will look forward with unwonted interest to the next great assemblage in the city of Rome, not soon forgetting the notable assemblage at Berlin, and the unbounded hospitalities which were so freely accorded.

THE PREVALENCE OF CHOLERA.—We have nothing of special import as to the spread of this disease beyond that which was noted in the last issue. It now prevails generally along the Arabian shores of the Red Sea, in Cairo, and along the southern shore of the Mediterranean. It has appeared in various provinces in Spain, advancing to the borders of Portugal. We hear nothing later of its supposed appearance in London.

AN ARMY MEDICAL BOARD will be in session in New York City, N. Y., during October, 1890, for the examination of candidates for appointment in the Medical Corps of the United States Army to fill existing vacancies. Persons desiring to present themselves for examination by the Board will make application to the Secretary of War, before October 1, 1890, for the necessary invitation, stating the date and place of birth, the place and State of permanent residence, the fact of American citizenship, the name of the medical college from whence they were graduated, and a record of service in hospital, if any, from the authorities thereof. The application should be accompanied by certificates based on personal knowledge, from at least two physicians of repute, as to professional standing, character, and moral habits. The candidate must be between 21 and 28 years of age, and a graduate from a Regular Medical College, as evidence of which his diploma must be submitted to the Board. Further information regarding the examinations may be obtained by addressing J. H. Baxter, Surgeon-General U. S. Army, Washington, D. C.

TOPICS OF THE WEEK.

RESULTS OF BACTERIOLOGICAL RESEARCH.

Upon this subject we quote the concluding portion of the able address of Dr. Robert Koch, at the late meeting of the International Medical Congress at Berlin. His words are as follows:

"Up till now I have purposely left one question untouched, although it is precisely the one which is most frequently, and not without a certain amount of reproach, addressed to bacteriologists. I mean the question of what profit all the weary labor which has up to the present been expended on the investigation of bacteria has been? Properly speaking, no such question should be asked, as true research follows its own way without being misled by the consideration whether its labors will yield immediate advantage or not. I cannot, however, deem this question utterly unwarranted in the present instance, as very few of those who occupy themselves with bacteriological research leave practical objects entirely out of sight.

"The practically available results obtained up to the present by means of bacteriological research are by no means so despicable as some askers of the above question think.

"I need only refer to that which has been accomplished in the domain of disinfection. Just at this point there was previously no foothold; men worked completely in the dark, and often enough large sums were spent in useless disinfection, leaving altogether out of account the indirect harm done in other ways by the neglect of hygienic precautions. Now, on the other hand, we possess certain knowledge by means of which we are able to test the efficacy of disinfectants, and if much still remains to be done in that province, we can at least affirm that the disinfectants now in use, so far as they have been tested, efficiently fulfil their object.

"Among the practical results might also be reckoned the application of bacteriological methods to the control of water filtration, as for that purpose nothing else can take the place of these methods. Connected herewith are the discoveries arrived at by means of bacteriological research as to the filtering properties of the soil, and the important consequences resulting therefrom as to the employment of ground water for water supply, and for the proper construction of wells. In the same way as in the case of water, bacteriological methods can be applied to the control of milk, especially as far as it is destined for the nourishment of children, as well as to the examination of other alimentary substances and other things in common use which are open to the suspicion of infection. The examination of the air in sewers, and the confirmation which the generally accepted opinion as to the injuriousness of sewer gas has thereby received; the examination of the air in schoolrooms, the recognition of pathogenic bacteria in alimentary substances, in the soil, etc., stand, as it is impossible to deny, in intimate relation with practice. Among the practical results I might further count the possibility which bacteriology has supplied of diagnosing sporadic cases of Asiatic cholera, and the first stages of pulmonary tuberculosis, the former being of importance for the prophylaxis of cholera, the latter for the timely treatment of tuberculosis.

"All these things, however, are advantages which can only indirectly be employed in the struggle against bacteria. We have hardly any directly acting, that is, therapeutical, agents to place beside the indirect ones. The only things which can be adduced in this connection are the results which Pasteur and others have obtained by means of protective inoculation in rabies, anthrax, quarter-evil, and swine erysipelas. With regard to antirabic inoculation, the only one which is applicable to man, it may be objected that the cause of rabies is not yet known, and probably may not be of a bacterial kind, and that this preventive inoculation should not be placed to the credit of bacteriology. Notwithstanding this, that discovery grew on bacteriological soil, and could not have been made without the antecedent discoveries of protective inoculation against pathogenic bacteria.

"Although in these directions, in spite of endless toil, bacteriological research has only such insignificant results to show, I am nevertheless not of opinion that this state of things will always continue. On the contrary, I am convinced that bacteriology will one day be of the greatest importance from the therapeutical point of view also. It is true, I look for relatively smaller therapeutical results in the case of diseases with a short incubation period and a rapid course. In these diseases, as for example in cholera, the chief reliance will always have to be placed on prophylaxis. I am thinking more of diseases of less rapid course, as these offer more points of attack to therapeutic enterprise. And there is scarcely a disease which, partly on this ground, partly on account of its far surpassing all other infectious diseases in importance, so challenges bacteriological investigation as tuberculosis.

"Moved by these considerations, very soon after the discovery of the tubercle bacilli, I set about seeking for substances which could be used therapeutically against tuberculosis, and I have pursued this search, which has, of course, been often interrupted by my other occupations, perseveringly up to the present. In the belief that there must be a remedy for tuberculosis, I do not by any means stand alone.

"Billroth has, in one of his last writings, expressed himself with all possible distinctness to the same effect, and it is well known that the same object is aimed at by many investigators. It seems to me, however, that the latter have not as a rule followed the right way in their investigations, inasmuch as they have begun their experiments on man. To that I ascribe the fact that everything which people have believed themselves to have discovered in that way—from benzoate of soda down to the hot-air treatment—has proved to be a delusion. Experiments must be made in the first place not on man, but on the parasites themselves in their pure cultures; even if substances have been found which have the power to check the development of tubercle bacilli in the cultures, man should not forthwith be chosen as the subject of experiment. But the question whether observations which have been made in a test tube hold good

also in living animal bodies should first be settled in animals. Only if the experiments on animals have proved successful, should the method be tried on man.

"Proceeding according to these rules I have in the course of time tested a very large number of substances to see what influence they would exert on the tubercle bacilli cultivated in pure cultures, with the result that not a few substances have the power, even in very small doses, of hindering the growth of tubercle bacilli. More than this, of course, a remedy cannot do. It is not necessary, as has often been erroneously assumed, that the bacteria should be killed in the body; in order to make them harmless to the body it is sufficient to prevent their growth, their multiplication.

"I have proved the following substances to be remedies which hinder such growth even in very small doses (to mention only the most important):—A number of ethereal oils; among the aromatic compounds, β naphthylamin, paratoluidin, xylidin; some of the so-called tar dyes, namely, fuchsin, gentian, violet, methyl blue, chinolin yellow, analine yellow, auramin; among the metals, mercury in the form of vapor, silver and gold compounds. The compounds of cyanogen and gold were especially conspicuous, their effect surpassing that of all other substances; even in a dilution of 1 to 2 millions they checked the growth of tubercle bacilli. All these substances, however, remained absolutely without effect if tried on tuberculous animals.

"In spite of this failure I have not allowed myself to be discouraged from prosecuting the search for growth-hindering remedies, and I have at last hit upon a substance which has the power of preventing the growth of tubercle bacilli, not only in a test tube, but in the body of an animal. All experiments in tuberculosis are, as everyone who has had experience of them has sufficiently discovered, of very long duration; my researches on this substance, therefore, although they have already occupied me for nearly a year, are not yet completed, and I can only say this much about them, that guinea pigs, which, as is well-known, are extraordinarily susceptible to tuberculosis, if exposed to the influence of this substance, cease to react to the inoculation of tuberculous virus, and that in guinea-pigs suffering from general tuberculosis even to a high degree, the morbid process can be brought completely to a standstill, without the body being in any way injuriously affected.

"From these researches I, in the meantime, do not draw any further conclusions than that the possibility of rendering pathogenic bacteria in the living body harmless without injury to the latter, which has hitherto been justly doubted, has been thereby established.

"Should, however, the hopes based on these researches be fulfilled in the future, and should we succeed, in the case of one bacterial infectious disease, in making ourselves masters of the microscopic, but hitherto victorious, enemy in the human body, then it will soon also be possible, I have no doubt, to obtain the same result in the case of other diseases. This opens up an oft-promised field of work, with problems which are worthy to be the subject of an international competition of the noblest kind. To give even now some encouragement to further researches in this direction was the sole and only reason why I, departing from my usual custom, have made a communication on a research which is not yet completed.

"Allow me, therefore, to conclude this address with the expression of a wish that the nations may measure their strength on this field of labor and in war against the smallest, but the most deadly, foes of the human race, and that in this struggle for the weal of all mankind one nation may always strive to surpass the other in the successes which it achieves."

ROME AS A PLACE OF MEETING.

No city in the world can offer attractions to visitors to equal those of the Queen City of Europe. To mention the name of Rome is to evoke in the minds of those who are familiar with the historic glories, the artistic treasures, and the monumental grandeur of that city, memories of an ineffaceable delight, to renew which must in itself be an invincible attraction; while to those who are acquainted with the storied beauties and undying loveliness of the palaces, the galleries, and classic remains of the Eternal City, such a visit must be looked forward to with eager anticipation. Rome, too, is now a centre of great scientific and literary activities, the capital of an illustrious nation, and one whose aspirations and repute, not less than its enthusiasm and its sympathies, will not allow it to dream of being backward in the organisation for the great reception, such as that of which London, Copenhagen, Washington, and Berlin have in turn afforded models. The invitation was all the more acceptable from being given by Baccelli, a former Minister of State, a President of the Italian Society of Medicine and of the Medical Academy of Rome, an orator, a statesman and a *savant*—one of the most brilliant of speakers, one of the most lovable of men, and one of the most distinguished of modern investigators. Under his invitation, and with the support which he is sure to find from the Government, from the municipality, and from his countrymen, we may be sure that the future Congress of Rome will have attractive features of its own, before which it is not improbable that all Congresses up to this date will pale their ineffectual fires.—*British Medical Journal.*

THE SURGICAL SECTION AT BERLIN.

The London *Lancet* correspondent makes allusion to this Section as follows:

"The material submitted to this Section was perhaps on the whole more remarkable for quantity than for quality; no great or startling innovation in surgery has marked this International Congress. Without doubt the various hospitals in Berlin have undergone great and radical changes in the last ten years. Many of them were shown to the Section, and in all lavish expenditure was more than apparent. The new hospital is quite unsurpassed by any yet built in its arrangement and technical fittings. It is evident that the aseptic, as opposed to antiseptic, method of operating has obtained a firm foothold in Germany."

PRACTICAL NOTES.

ECZEMA OF DENTITION.

For eczema of dentition, treatment is to be directed to three indications (*Gazette Hebdom.* in *Annals of Gynecology and Pediatry*, July, 1890).

1. To calm pruritus of the gums, frequent rubbing with the finger dipped in a solution of the following:

℞ Cocaine hydrochlorat., gr. j.
Potass. Bromid., gr. x.
Glycerine.
Aqua destillat, ää ʒss. M.

2. For insomnia a dessertspoonful hourly of—

℞ Sodii bromidi, gr. xij.
Syrup aurant flor., ʒiij. M.

3. For the local eczema the following:

℞ Zinci oxid., gr xx.
Vaselini, ʒj. . .

—*Buffalo Med. and Surg. Journal.*

ANTIPYRIN IN CUTANEOUS AFFECTIONS.

One of the symptoms which is most disagreeable in a large number of skin diseases, is the intense itching or soreness which causes scratching, with consequent injury to the parts involved. Many remedies are now added to the applications usually ordered to allay this troublesome state. Chief among these are carbolic acid, menthol, chloral hydrate, and cocaine, but even these often prove inefficient. According to Blaschko, of Berlin, antipyrin proves a most valuable remedy under such circumstances, and he recommends that for infants the following be given internally:

℞ Antipyrin, ½ drachm.
Simple syrup, 1 oz. M.
Dose, half a teaspoonful at night before going to bed.

Sometimes large doses are needed, but excellent results are to be obtained by this means in eczema, urticaria, strophulus, pemphigus, lichen ruber and planus. Not only does it prove palliative, but often curative, probably by preventing scratching. Antipyrin may also be used for hysterical pruritus with advantage, but in adults must be given in full doses and frequently.—*Medical News.*

HYPNAL IN THE TREATMENT OF NEURALGIC INSOMNIA.

Dr. Fraenkel reports, in *Nouveaux Remèdes*, that he has prescribed hypnal in various cases at his clinic, and that sleep resulted as with chloral, and with the characteristics of the sleep produced by the latter drug—that is, a calm and refreshing sleep, without nausea or disagreeable sensations on awakening—and that the painful symptoms improved as they improve after the administration of antipyrin. Hypnal, or monochloralantipyrin, is a chemically well-defined compound that is less soluble than either chloral or antipyrin; in the presence of a feeble alkali it is resolved into these substances, and this decomposition occurs in the blood or in the intestine. It has only a slight taste and odor, and is easily administered to children. It produces the hypnotic effect of chloral augmented by the analgesic action of antipyrin, and is especially valuable in insomnia caused by pain. It may be administered in capsules or powders, in doses of 15 grs., to an adult, that may be repeated if necessary. For a child the dose is from 1 gr. to 10 grs.—*N. Y. Medical Journal.*

FRUIT AT MEALS.

As a rule, a fruit dessert in the evening and after a mixed meal ought only to be lightly indulged in, for the average stomach will but rarely tolerate a heavy influx of such cold and usually watery aliment as fruit. This is not the case if the fruit is eaten before or between the meal courses. A ripe melon eaten with salt or butter, before or immediately after the soup, can be freely indulged in. Experience teaches us that stewed or raw fruit may be largely taken between the courses. In many parts of the Continent this custom prevails; the Germans eat stewed fruit with many meats, and in warmer climes such fruit as grapes, plums, figs, melons and sweet lemons are habitually eaten with all kinds of dishes as palate refreshers between the courses. —*Annals of Hygiene.*

ACETANILID IN EPILEPSY.

Dr. Theodore Diller, of Danville, has been using acetanilid in the treatment of epilepsy in nine cases in which bromides and other modes of treatment had previously been employed. He finds that in all the cases in which the drug was given continuously there was noted a reduction in the number of fits ranging from about 25 to 75 per cent., as compared with other months during which the patients were on bromide and tonic treatment alternately. The remedy was in all cases well borne, producing no apparent mental or physical depression, this forming a marked contrast to the depressant effects noted after a course of bromides. No skin eruption was produced. In spite of these results, however, he believes that in any given case, in which a great number of fits are occurring, and where it is desirable to control them as soon as possible, bromides would be of far more value than acetanilid. From the table appended to his paper it would appear that the beneficial effects of acetanilid were most marked only after the drug had been employed for over three months. In two cases no improvement followed the use of acetanilid.—*Lancet.* [Dr. Beaumetz proposed the use of exalgine in epilepsy, and Déferine is now testing the new drug at the Bicetre.]—*N. Y. Med. Abstract.*

SOCIETY PROCEEDINGS.

Tenth International Medical Congress, Berlin, August, 1890.

DR. H. C. WOOD, of Philadelphia, delivered before the Congress

AN ADDRESS ON ANÆSTHESIA.[1]

He said: The most brilliant modern achievements of the science and art of medicine in the direct saving of life are connected with surgery. These great achievements have been rendered possible by two epoch-making discoveries—antisepsis and anæsthesia. The long array of fatal cases of poisoning by carbolic acid, by iodoform, by corrosive sublimate, and by other antiseptic agents; the hundreds of deaths from chloroform, ether, and other anæsthetics, all bear witness to the verity of that strange law, in obedience to which the progress of the human race is so often at the sacrifice of the individual. Antisepsis has outgrown the dangers of its youth, and to-day the measures that are meant to save very rarely kill. On the other hand, the death roll of anæsthesia is daily added to—added to, according to my belief, at a rate that has not changed in forty years. Though this be true, from far-off Australia comes the news that jury and judge have condemned to heavy penalty a chloroformist who had lost his patient; and in England itself a well-known medical journal lends support to such a verdict by affirming that "deaths from chloroform are preventable, that with due care they may be avoided," and that, therefore, when they occur they are the result of ignorance and carelessness. If this be true, five hundred deaths and more—the result of ignorance or carelessness! Five hundred surgeons, including such names as Billroth, Jaeger, Simpson, McLeod, Agnew, Hunter McGuire, and others of equal rank, guilty of manslaughter! And still the carnage goes on. Surely, under such circumstances, the subject of anæsthesia is worthy of the attention even of this, the most learned medical gathering of the nations that the world can furnish. Antisepsis, the gift of the Old World to humanity; anæsthesia, the gift of the New World, which made the fruits of antisepsis possible—surely it is fitting that I, standing here to-day before you all as the representative of the newer civilization, should be the chosen mouthpiece for the renewed discussion of this old but pressing theme.

In attempting a fresh study of a well threshed-out subject, I propose to take advantage of the modern physiological methods, and to endeavor to discover by experiments upon the lower animals how anæsthetics kill, and what drugs or measures are most powerful in putting aside their lethal effects. This brings us face to face with the question, How far is it possible to adapt experiments to the needs of practical medicine, and to reason from the dog to the man? A full discussion of this subject would not be opportune, but it does seem necessary for our purpose to devote a few minutes to the pointing out of certain general guiding principles.

It ought to be acknowledged as a fundamental axiom, that no amount of experiments can overthrow a clinical fact, although when a contradiction between experimental and bedside observation seems to arise, such contradiction challenges the correctness of the alleged clinical and experimental facts alike, and should lead to careful re-examination. No amount of failure to purge a dog by elaterium proves that elaterium does not purge man; whilst, on the other hand, the discovery that digitalis increased the blood pressure in the lower animal very properly led to doubt as to the correctness of the, at that time general, belief that digitalis acts upon man as a cardiac sedative, and finally to the recognition of the falsity of the clinical observation upon which such belief rested.

Whatever difficulties may beset the path of the experimental therapeutist, it is certain that law is throughout the universe supreme; that man, at least in his physical nature, is only an especially developed animal; and if drugs act differently upon different animals, such action must be in obedience to certain laws, to us known or unknown.

Any attempt to fairly discuss these laws would lead us too far afield for the present. One law, however, treads so closely upon the matter at hand this morning, that it requires statement. This law is, that when an apparatus or system is of similar function, and of similar functional activity in different animals, the difference in the action of remedies is very rarely, if ever, in kind, though it may be in degree. Throughout mammalia the heart has one general structure and one general function; the heart of the dog responds to the touch of digitalis precisely as does the heart of the man. The human brain is so much more highly developed than the brain of the lower mammal that it is, in fact, a new organ or apparatus, and its relation to drugs changes with the change of structure and of function. The scope of this law in regard to anæsthesia is not far to seek. The functions especially compromised in lethal anæsthesia are respiration and circulation. Surely these functions are similar throughout mammalia, and surely we ought to be able to safely reason concerning them from the dog to the man.

Recently, however, alleged clinical facts have been challenged by high authority, upon the strength of experimental results. Under these circumstances, nothing must be at once abandoned, everything must be reëxamined. These

[1] British Medical Journal, August 16, 1890.

reëxaminations I have made, and I may be pardoned, perhaps, if I affirm that a complete study of the clinical and experimental evidence brings out, not a discord, but a most beautiful concord — that concord between experimental and practical medicine which so often fails to appear simply because we cannot fit together the fragments of truth in our possession.

Although numerous substances have been tried, there are to-day in use practically only three anæsthetics—nitrous oxide, ether, and chloroform. Of these, nitrous oxide stands apart, because it produces loss of consciousness, not by virtue of any inherent properties, but simply by shutting off from the nerve centres the supply of oxygen.

It has been asserted that the changes of circulation produced by the inhalation of nitrous oxide are essentially different from those of mechanical asphyxia, and that therefore nitrous oxide does not act as an asphyxiant. It must, however, be borne in mind that the phenomena of mechanical asphyxia are largely due to to the presence of an excess of carbonic acid in the blood, whilst in the asphyxia produced by nitrous oxide there is no excess of carbonic acid, so that the phenomena present are simply the outcome of a lack of oxygen. It is, therefore, *a priori*, to be expected that the phenomena of mechanical and of nitrous oxide asphyxia should differ to a certain extent. To determine the way in which nitrous oxide inhalation affects the circulation, I have, during the past winter, in connection with my assistant and friend, Dr. David Cerna, made a long series of experiments. The result has been to show that usually the inhalation is followed by a rise of the arterial pressure, accompanied by a great disturbance of the pulse; the pulse at first becoming irregular and tumultuous, but by-and-bye settling, so that when anæsthesia is complete the pulse wave is remarkably large and full, and the rate very slow. The rise and fall of the arterial pressure in nitrous oxide anæsthesia was found to vary remarkably, not only in different inhalations, but in different periods of the same inhalation. Sometimes the rise was sudden, sometimes it was slow and gradual; sometimes it was maintained until near death, sometimes it was interrupted very early; sometimes it was not very well marked, sometimes it was enormous.

In all our experiments respiration ceased while the heart was still in full activity. Indeed, instead of the gas acting as a cardiac depressant, it appeared to act as a cardiac stimulant, although it paralyzed the vasomotor apparatus. Thus, during complete anæsthesia, faradization of the sciatic nerve always failed to register itself in an increase of the blood pressure, although the heart was beating very powerfully, and although the pneumogastrics had been previously severed; whilst late in the poisoning—at a time when the respiration had absolutely ceased, and the animal was in this respect dead, and without the power of self-recovery, and when the arterial pressure also had fallen almost to zero—the pulse waves were frequently still nearly three times the normal.

We made but few experiments as to the action of artificial respiration upon the animal dying from nitrous oxide, but these experiments proved that even after complete paralysis of the respiratory function, artificial respiration is capable of rapidly bringing the animal back to life. The heart lives on through nitrous oxide anæsthesia long after the respiratory function has been abolished, and even when the strong, full pulse fails, and the heart has almost ceased to quiver, recovery is still hopeful, because the loss of function has been caused, not by the presence of a poison, but by the absence of oxygen; and although the paralysis may be complete, the life power sleeps before it dies, and is ready to awake at the touch of fresh oxygen.

These experimental results are in strict accord with clinical observations. The S. S. White Dental Manufacturing Company supply a very large, if not the largest, portion of the apparatus and material used for the administration of nitrous oxide in the United States; and, in answer to my inquiry, Dr. J. W. White, their President, writes me that a computation based upon their own sales, and a knowledge of those of their rivals, has reached "the somewhat appalling result, that anæsthesia by nitrous oxide gas is probably effected in three-quarters of a million cases annually in the United States." Most of these inhalations have been given, not by trained physicians, but by comparatively untrained and often very ignorant dentists; have been given to patients in a sitting or semi-sitting posture; have been given apparently without thought or care to the general community, as the units presented themselves; to the healthy and to the diseased alike; and the result is, out of many millions of inhalations, only three deaths recorded as directly due to nitrous oxide. Could anything be safer?

A suggestive and very practical fact which came out in our experiments is that sometimes during an inhalation of nitrous oxide the rise of the arterial pressure is extraordinary and abrupt. Not long since, in the city of Philadelphia, a gentleman arose from the dentist's chair after an inhalation of nitrous oxide, staggered, and fell in an apoplexy. Is it not easy to perceive that when the arterial system is diseased the great strain of a sudden rise of blood pressure may produce rupture?

Some years since Dr. Kenderdine, a Philadelphia surgeon of local note, died of diabetes, which he insisted was produced in him by the inhalation of nitrous oxide. This is in accord with the researches of the French physician, Dr. Lafont, who reported a case in which sugar appeared in the urine twice in a patient after the inhalation

of the gas, and who also caused in himself, and in dogs, temporary glycosuria by such inhalations. Further, Dr. Lafont noticed in a case of mitral insufficiency temporary albuminuria.

I am not aware that these very suggestive statements of the French physician have given rise to any research, except five experiments made recently upon healthy men, with negative results, by two medical students of the University of Pennsylvania, Messrs. George S. Woodward and Alfred Hand, jun. I do not believe that ordinarily the inhalation of nitrous oxide is followed by sufficient disturbance of the circulation to register itself in the urine, but the negative evidence of Messrs. Woodward and Hand is not sufficient to render it improbable that in exceptional cases the inhalation of nitrous oxide may produce albuminuria or glycosuria. Such phenomena, if they occur, are in all probability not directly produced by the nitrous oxide, but are due to the disturbances of capillary circulation caused by it.

However these facts may be, it seems to me that great caution should be used in the administration of nitrous oxide to persons the coating of whose arteries is diseased, and it is probable that when widespread atheroma exists, ether is a safer anæsthetic than nitrous oxide.

When respiration has been suspended in nitrous oxide anæsthesia, the overwhelming indication is certainly for the employment of artificial respiration.

Notwithstanding the great safety and the many advantages which attend the anæsthetic employment of nitrous oxide, the gas can never be used for the general purposes of the surgeon, on account of the excessive fugaciousness of its influence.

The perfect anæsthetic will be a substance which has the power of paralyzing the sensory nerve trunks without affecting other functions of the body. If such drug exists it yet awaits the coming of its discoverer. Probably until such a sensory-nerve paralysant is found chloroform and ether will maintain the complete supremacy which they now have; and in the further discussion of my subject I shall confine my remarks to them. Lack of time limits this discussion to:

1. The method in which these two drugs kill, both in man and in the lower animal, that is, whether they destroy life through the circulation or the respiration.

2. The comparative fatality attending the use of these two agents, and the reasons for the difference.

3. The comparative disadvantages between the two agents, and the best method of securing the desired results.

4. The treatment of accidents occurring during ether or chloroform anæsthesia.

In regard to the method in which anæsthetics kill, my own teaching hitherto has been: First, that although ether in moderate doses acts as a stimulant to the circulation, yet, in overwhelming amount, it is capable of depressing the heart, but that such depression of the heart is always less than the depression of the respiration, and therefore ether kills always through the respiration; secondly, that chloroform may produce death by paralysis of the respiratory centre, or by a simultaneous arrest of respiration and circulation, but that primary paralysis of the heart may occur, and is especially prone to do so when the chloroform vapor has been given in concentrated form.

I think that these views are in accord with general professional belief, but it has recently been alleged that they are at variance with experimental evidences, so that a re-examination is necessary. What, then, are the clinical facts?

If any credence is to be attached to the statements of competent witnesses, who have recorded human deaths during anæsthesia, it is certain that in some cases, under the influence of chloroform, the pulse and respiration have ceased simultaneously; whilst in other instances the respiration has failed before the pulse; and in still other cases the pulse has ceased its beat before the respiratory movements were arrested.

Usually ether arrests respiration in man before it paralyzes the heart, but the collection of records made by Dr. J. C. Reeves certainly show that the fatal result may be produced by syncope. Thus Dr. Ernest H. Jacobs, in a report of a fatal case, asserts positively "the pulse ceased, the breathing continued." It would seem that we must allow that ether in the human subject may cause death in the same methods as does chloroform.

Such then are the clinical facts; or in other words, such are the results of observations made upon the human subject. What are the results of observations made upon animals?

The general teaching in regard to chloroform has been recently challenged by Dr. Lauder Brunton, who, as the result of 450 experiments made by himself upon the pariah dogs of India, has reached the conclusion, as published in the London *Lancet*, that however concentrated the chloroform may be it never causes death from sudden stoppage of the heart. In the physiological laboratories of the University of Pennsylvania, for some years, several hundred dogs have been used annually, and a very large proportion of these dogs have been, at the end of an experiment, killed by chloroform. The observations of Dr. Reichert, Professor of Physiology in the University, Dr. Hobart Hare, Demonstrator of Therapeutics, and myself, have been concordant in showing that chloroform is a cardiac paralysant, and often does kill dogs by a direct action upon the heart or its contained

ganglia. The statements made concerning the Hyderbad Commission, however, led Dr. Hare and myself to a careful and thorough restudy of the subject. Some of our experiments were made by injecting chloroform into the jugular vein; others by administering it by inhalation in the usual way.

The action of the chloroform seems to be not seriously modified by the method of administration. We definitely proved that in the dog chloroform has a distinct, direct, paralyzing influence on both respiration and circulation; that the respiration may cease before the heart beat, or the two functions be simultaneously abolished; but that in some cases the heart is arrested before respiration. We have several times seen the respiration continue as long as one, and even two minutes after the blood pressure has fallen to zero, and the pulse has completely disappeared from the carotid artery.

The correctness of our experiments, we claim, must be acknowledged. The experiments have not only been witnessed by a number of persons, but I have with me to-day tracings which I will gladly show anyone especially interested in the subject. I do not desire to express any doubt whatever as to the correctness of the experimental data of Dr. Brunton; I simply claim that both sets of experiments, although they have yielded different results, have been correctly and properly performed. It may be that the high heat or other climatic conditions surrounding the pariah dog make his heart less sensitive to the action of chloroform than is the heart of the dog bred in northern climates. That the thought of the different constitutions of animals in different climates is not absurd, is shown by the fact that some years ago—after I had affirmed before the Physiological Section of the International Medical Congress at London, that if certain asserted results were obtained upon European dogs, said dogs must differ from those of America, and had been met with a smile of incredulity—Dr. Brown Séquard rose and stated that he had experimented upon hundreds of dogs on both continents, and that there was a distinct difference between the animals, the vascular system of the European dogs being much more developed, and operations upon them being, therefore, much more bloody than was the case with the American dog.

A very curious parallel might be traced at this point between the experimental and clinical evidence in regard to the effect of climate upon the action of chloroform. In the Southern United States chloroform is used with great freedom, and with great alleged safety; and as long ago as 1878, Dr. Landon B. Edwards, editor of the *Virginia Medical Monthly*, wrote: "It is one of the most peculiar effects I have ever known in medical practice—the difference of experience in Europe and the North with chloroform and ether as compared with that of the South—the high rate of mortality in the North, and the low rate in the South." Further, in a recent letter to me, Sir Joseph Fayrer affirmed the extraordinary safety of chloroform in India, and stated that he knew of no death from it as having occurred in that country, although its use is universal.

In a series of experiments which I have recently made myself to determine the changes in the circulation produced when ether anæsthesia is carried on to death, I have found that in the first periods of anæsthesia the blood pressure is usually elevated, and that it is usually quite high at a time when the respirations are very shallow and imperfect, and the dark color of the blood shows that it is heavily charged with carbonic acid. It is not, however, very rare for the blood-pressure to remain near the normal, and I have seen the blood-pressure begin to fall in the very first stages of ether anæsthesia; moreover, in at least two experiments, death occurred from syncope, the respiration continuing for one or two minutes after the complete cessation of the circulation. In an experiment in which the fall of blood-pressure was most pronounced, and the arrest of the heart most complete, the dog was sick from the mange, and it is possible that the weakened heart was more susceptible than is the normal heart to the depressing influence of ether.

So far, then, as concerns the method in which ether and chloroform kill, I claim most urgently that there is no contradiction between the results as obtained by the bedside and in the physiological laboratories, and that a complete broad study of the clinical and experimental evidence leads to one conclusion, namely, that chloroform and ether are capable of paralyzing the respiration and the circulation; that in some cases one function, in other cases the other function, is primarily arrested; but that ether is less prone to produce a primary arrest of the heart than is chloroform.

In the discussion of the second point which I have raised, namely, as to the comparative fatality attending the use of ether and chloroform, I shall not occupy time with any elaborate setting forth of the clinical evidence. In regard to the number of recorded deaths, I shall content myself with accepting the latest statistics at hand, namely, those collected by Dr. Lawrence Turnbull, who has found 375 deaths reported from chloroform, and 52 from ether. I do not believe that these figures nearly represent the total mortality; I doubt very much whether one-third of the deaths from anæsthesia are reported; certainly not one-third of the cases I have had personal knowledge of having been publicly recorded. Moreover, the pressure to conceal deaths from chloroform, is greater than when the lethal re-

sult is due to ether. The surgeon who uses ether feels that he has employed the safest anæsthetic, and that he will receive no blame if a death occurs from it, and feels also that he has a rare case to put on record, which will give his own name a permanent place in anæsthetic literature; whereas the surgeon who uses chloroform knows that if death occur from the anæsthetic, a very large proportion of the profession, at least in the United States, will condemn him either in public or in secret for the use of this drug, and that he will be fortunate if he escape being publicly condemned by a coroner's jury. Moreover, deaths from chloroform are only too common, so that the surgeon has nothing to gain and much to lose by publication of a chloroform death, and, if possessed of the average human nature, holds his peace.

It seems to me impossible to get at the exact number of anæsthetic deaths, or the proportionate fatality of ether and chloroform. Lyman considers that in regard to chloroform, the ratio of deaths to inhalations is one in 5,860; Richardson affirms that it is 1 in 2,500 to 3,000; Andrews puts it for ether at 1 in 23,204; and Lyman at 1 in 16,542.

Without claiming strict accuracy for any of these figures, I think that it can be asserted that the probable ratio of deaths from chloroform is three to five times that of deaths from ether.

When we come to study the effects of chloroform upon the lower animals, we find that it varies very distinctly in its action on the different species. The cat seems to withstand the fatal influences of chloroform with a power worthy of its reputed "nine lives." Many years ago, Professor Schiff called attention to the fact that the use of chloroform as an anæsthetic in the dog is usually attended with the loss of many animals. Prof. Martin, of the Johns Hopkins University, writes me that the margin between complete chloroform anæsthesia in the dog, and chloroform death, is a very narrow one. This certainly is our experience in the University of Pennsylvania; we have never been able to use chloroform as an anæsthetic without losing a very large proportion of our dogs.

(*To be concluded.*)

MISCELLANY.

HEALTH IN MICHIGAN.—For the month of July, 1890, compared with the preceding month, the reports indicate that cholera infantum, cholera morbus, cerebro-spinal meningitis, dysentery, whooping-cough, diarrhœa, typho-malarial fever, and inflammation of bowels increased, and that membranous croup, measles, pneumonia and influenza decreased in prevalence.

Compared with the preceding month the temperature was slightly higher, the absolute humidity and the relative humidity were less, the day ozone and the night ozone were less.

Compared with the average for the month of July in the four years 1886–1889, membranous croup, measles and influenza were more prevalent, and small-pox, puerperal fever, typho-malarial fever and typhoid fever were less prevalent in July, 1890.

For the month of July, 1890, compared with the average of corresponding months in the four years 1886–1889, the temperature was lower, the absolute humidity and the relative humidity were less, the day ozone and the night ozone were more.

Including reports by regular observers and others, diphtheria was reported present in Michigan, in the month of July, 1890, at 50 places, scarlet fever at 55 places, typhoid fever at 29 places, and measles at 72 places.

Reports from all sources show diphtheria reported at 8 places less, scarlet fever at 3 places more, typhoid fever at 1 place more, and measles at 36 places less in the month of July, 1890, than in the preceding month.

ANTISEPTIC DUELING.—In a recent duel with small swords, just as the principals were in position, a loud voice exclaimed: "One moment, gentlemen!" At the same instant a surgeon sprang forward with a bottle in his hand. This surgeon was imbued with modern ideas, and taking the swords he dipped their points in a solution of phenic acid, remarking as he handed them to the duelists: "Gentlemen, you may now kill each other without danger of purulent infection!"—*Medical Age.*

ALBUMEN IN URINE.—A solution of one part of acetic acid, and six parts of 1 per cent. solution of corrosive sublimate is prepared; to this the suspected urine is slowly added, which at once produces a distinct cloudiness. This test is not affected by peptones, uric acid, or the phosphates.

LETTERS RECEIVED.

Dr. George W. Webster, Dr. S. B. Collins, Chicago; Dr. E. E. Montgomery, Buffalo, N. Y., Dr. Joseph F. Hobson, Cleveland, O.; Dr. Carrol Dunham, Irvington-on-Hudson, N. Y.; Dr. B. Chapman, Copley, O.; Dr. D. Y. Winston, Russellville, Ky.; Dr. R. S. Brice, Keota, Ia.; Dr. W. R. Greenlee, Harriston, Miss.; Dr. G. L. Buland, Greenwood, Wis.; Mr. D. R. Craig, Keokuk, Ia.; Dr. J. W. Breedlove, Fort Smith, Ark.; Dr. C. D. Watson, Ontario, Cal.; Henry Bernd & Co., St. Louis; Dr. Hannah T. Croasdale, Dr. Richard H. Harte, Philadelphia; Dr. B. M. Ricketts, Cincinnati; Dr. Carl Koller, Med. Monthly Publishing Co., New York City; Dr. Louis A. Kengla, San Francisco; Dr. Maris Gibson, Wilkesbarre, Pa.; Dr. L. J. King, Visalia, Cal.; Dr. R. C. Ward, Northfield, Mass.; Dr. J. W. Stickler, Spring Lake, N. J.; Dr. H. M. Brown, Hillsboro, O.; J. H. Bates, Dr. W. R. Townsend, Scott & Bowne, R. Terhune, W. P. Cleary, New York City; W. D. Kline, Nashville, Tenn; Dr. Guido Bell, Indianapolis, Ind.; Dr. H. W. Elmer, Bridgeton, N. J.

Official List of Changes in the Medical Corps of the U. S. Navy for the Week Ending August 30, 1890.

Medical Inspector A. A. Hoehling, in addition to present duties, ordered as President of Medical Examining Board at Philadelphia, convened by Department order June 9, 1890.

Asst. Surgeon R. M. Kennedy, in addition to present duty, ordered as member of the above Board.

P. A. Surgeon F. N. Ogden, in addition to present duty, ordered as member of the above Board.

Surgeon Walter A. McClurg, granted a month's leave of absence from September 1.

Surgeon Edward Kershner, granted a week's leave of absence from September 1, 1890.